COLLISION AVOIDANCE SYSTEM EQUIPMENT AND COMPLIANCE DEADLINES

(101-6)

HEARING

BEFORE THE

SUBCOMMITTEE ON AVIATION

OF THE

COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

MAY 4, 1989

Printed for the use of the Committee on Public Works and Transportation

U.S. GOVERNMENT PRINTING OFFICE

19-513 WASHINGTON : 1989

For sale by the Superintendent of Documents, Congressional Sales Office
U.S. Government Printing Office, Washington, DC 20402

H641-34

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COLLISION AVOIDANCE SYSTEM EQUIPMENT AND COMPLIANCE DEADLINES

Summary of Subject Matter

Public Law 100-123 (The Airport and Airway Safety and Capacity Expansion Act) enacted on December 30, 1987, directed the Federal Aviation Administration to require that all airline aircraft with at least 30 seats carry an on-board collision avoidance system known as TCAS II (Traffic Alert and Collision Avoidance System) by December 30, 1991.

More specifically, the law directed the Federal Aviation Administration to establish an 18 month schedule to complete certification of production units of TCAS. Following FAA certification of the technology, the law stipulated that airlines would have 30 months to install TCAS in their aircraft fleets.

The FAA issued its Final Rules on TCAS in January of this year. Approximately 4,000 aircraft are subject to the new requirements.

Last year the airline industry began expressing concerns about what it viewed as the short length of the compliance schedule and the lack of a program to have a large scale operational test and evaluation of the technology. The airline industry's concerns about the compliance schedule revolve around their analysis that there is not enough maintenance and engineering capacity within their organizations to accomplish the complex installation within the time frame now allowed. The industry is also being required to install new wind shear detection technology during this period as well, and the industry would benefit economically if the installation schedules for TCAS and the wind shear detection equipment could be coordinated. To accomplish this, the industry believes approximately two additional years will be required.

With respect to operational testing evaluation, the industry believes that a large number of aircraft (20 percent of the fleet) need to be involved in a further analysis of how TCAS will work in the air traffic control system on a day-in and day-out basis. Flight testing to date has been limited to certifying the device itself. There is general concurrence in the industry and the FAA that the "bugs" have been worked out of the technology, but the industry believes that more needs to be understood about how flight crews and air traffic controllers will use and respond to this new technology in the operating environment.

Informally, the FAA has expressed similar concerns.

OFFICE OF TECHNOLOGY ASSESSMENT REPORT

Last September, the Congress' Office of Technology Assessment was asked to do an analysis of the need for an operational test and

evaluation and an extension of the final compliance deadline beyond December 30, 1991.

The OTA issued a report Safer Skies with TCAS, in February of this year, and a copy of the conclusions and recommendations section of that report are attached to this summary. In short, the conclusions are:

The original TCAS II compliance deadline (12/91) has safety, economic, and international consequences not fully foreseen at the time of enactment.

OTA recommends no delay in initial implementation, a phased implementation schedule, and a two-year extension of the 100 percent fleet installation deadline.

OTA further recommends a structured evaluation of system performance, conducted jointly by industry and the FAA, during the first year of system operation (15 to 30 percent of fleet equipped).

H.R. 2151

Representative Packard has introduced a bill, H.R. 2151, which also calls for a phased TCAS–II implementation schedule (25 percent installation by December 30, 1990, 50 percent installation by December 30, 1991, and 100 percent installation by December 30, 1992) and an early evaluation program. The bill allows a one year extension to the current 100 percent installation deadline. The bill allows the FAA Administrator to extend the December 30, 1991 50 percent installation deadline. The bill also calls for the FAA Administrator to consider adjusting the current wind shear installation schedule to match that proposed for TCAS. (The current wind shear detection equipment installation schedule calls for 50 percent implementation by January 2, 1991, and 100 percent implementation by January 2, 1993).

THE TCAS TECHNOLOGY

TCAS is a sophisticated system carried on board an aircraft consisting of a computer processor, a directional antenna system, a mode-S transponder, and cockpit displays indicators and controls. When a transponder signal is received, the TCAS computer analyzes whether the paths of the TCAS-equipped aircraft and the other aircraft will conflict and violate aircraft separation standards. If the computer determines that a conflict will occur, the computer issues an advisory to the flight crew to either climb or descend approximately 40 seconds prior to the separation standard being violated. In cases involving jet aircraft moving at cruise speed it is unlikely the flight crew could see the other aircraft at the time of the advisory because of the distances involved.

In testimony presented to the Committee two years ago, the FAA stated that with the airline fleet equipped with TCAS, the risk of mid-air collisions involving airline aircraft would be virtually eliminated.

A brief description of each of the TCAS types is summarized below, as well as a summary of transponder types.

TCAS–I: Helps the pilot in visually acquiring nearby traffic. Detects and displays range, approximate bearing, and altitude of traffic equipped with Mode C or S transponder within 4 nautical miles

of the host aircraft. Alerts crew with visual and aural advisory. Does not offer maneuver guidance.

TCAS–II: Encompasses all TCAS–I capabilities, but with greater range and accuracy. TCAS II also provides the crew with maneuver guidance (climb or descend only) to avoid collisions, provided the other aircraft is Mode C or S transponder equipped. With Mode S air-to-air data links, TCAS II will coordinate avoidance maneuvers with other TCAS II equipped aircraft.

TCAS–III: Encompasses all TCAS II capabilities, but also includes horizontal collision avoidance guidance.

Transponders: Existing on-board equipment which responds to electronic interrogation by air traffic control radar. There are three types of transponders:

Mode A.—aircraft identification code only;

Mode C.—aircraft identification and altitude; and

Mode S.—aircraft identification, altitude, and other specific information.

HISTORY OF COLLISION AVOIDANCE DEVELOPMENT

Following a midair collision between two commercial transports over the Grand Canyon in 1950, the airline industry began to develop an airborne collision avoidance system (ACAS). A number of concepts were explored and developed from 1956 to 1971, however, the FAA believed that available commercial systems needed more testing before any national implementation.

From 1972 to 1976 the FAA tested several commercial systems and found that none were compatible with the ATc radar system, among other problems with false alarms and electromagnetic interference. Another technology, the Beacon Collision Avoidance System (BCAS), was pursued by the FAA from 1976 to 1981. Although BCAS had the advantage of utilizing already installed aircraft avionics, technological problems, particularly in dense air traffic, were not resolved.

In 1981 the FAA began work on the Traffic Alert and Collision Avoidance System (TCAS) which also was to rely primarily on existing avionics signals, but would resolve problems associated with high density traffic. Designed as a family of collision avoidance systems, TCAS–I was to be used on general aviation aircraft and TCAS II and TCAS III were designed for airliner aircraft. Since that time, the FAA has emphasized TCAS II development, which has progressed through a series of milestones, including engineering design, technical standardization, and operation testing.

EXPECTED WITNESSES

Representatives from the following organizations are expected to testify:

Office of Technology Assessment;

Federal Aviation Administration;

Air Transport Association; and

Air Line Pilots Association.

SAFER SKIES WITH TCAS—TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM

(Summary of Office of Technology Assessment Report)

The pilots "felt naked without [TCAS] when the evaluation was over."—*United Airlines, Summary User Evaluation Report*

The compliance deadline established in Public Law 100-223 for implementing the Traffic Alert and Collision Avoidance System (TCAS II) has safety, economic, and international consequences not fully foreseen at the time of enactment. The TCAS II program is unique in the combination of technological complexity, rapid introduction, and the number of aircraft affected. OTA finds that aviation safety will be best served by introducing TCAS II on commercial aircraft as soon as possible, by requiring a phased implementation schedule, and by providing for a structured evaluation program carried out jointly by industry and the Federal Aviation Administration (FAA) to oversee the first year of operation.

While evaluations to date have indicated that TCAS II works quite well, no more than two TCAS II equipped commercial aircraft have flown at any given time. The reactions and interactions of pilots, controllers, and TCAS II within the air traffic system cannot be understood until large numbers of aircraft equipped with TCAS are in operation. OTA concludes that to ensure full safety benefits, a critical number of aircraft must be outfitted with TCAS II at an early date—possibly 15 to 30 percent (600 to 1,200 aircraft) of the commercial fleet by December 1990. Industry and FAA will need to cooperate in an evaluation that covers the spectrum of aircraft and airspace types and allocates sufficient resources for collecting, analyzing, and disseminating date.

Public Law 100-223 requires that airlines meet a December 30, 1991, installation deadline for TCAS II. This will strain the resources of virtually every participating aviation organization. Manufacturers must produce and deliver equipment, airlines and others must redesign and modify aircraft, and FAA must certify equipment and altered aircraft. While many major airlines can probably meet the deadline, other critical maintenance and modification programs are likely to suffer. Airlines will have to remove about one-half of their fleets from scheduled service for at least a few days to install TCAS II. Faced with limited numbers of skilled technicians and engineering and maintenance resources, airlines plan to contract out TCAS II work, use overtime, cut discretionary maintenance, and petition for exemptions from other maintenance requirements, such as inspection and modification of aging aircraft. Development is still incomplete for some TCAS II display options ground test equipment, and technology suitable for commuter aircraft, compounding the uncertainties surrounding installation time.

Out-of-service time for aircraft raises equity issues separate from the direct costs of installing TCAS II. Airlines without extra aircraft are likely to lose passengers to other airlines for a short time, whereas companies with more resources can avoid canceling service. Airlines that fail to meet the deadline will be penalized severely if unequipped aircraft are not permitted to fly in U.S. airspace

in 1992. However, airlines that complete TCAS II installations on time will face indirect cost penalties if their competitors do not commit similar resources and are granted extensions.

Although OTA finds no reason to delay initial TCAS II implementation, sufficient airline resource limitations, economic inequities, and international implications stem from the present deadline for Congress to consider extending the installation schedule. If an extension is enacted, specific requirements in the same law will be needed to ensure that installation of TCAS II begins promptly after production equipment is available and proceeds at a reasonable pace over the span of any extension. Prompt congressional consideration of any change to Public Law 100-223 is also important. Indeed, the forcing effect of legislation is likely to be necessary to ensure maximum safety benefits as early as possible and to allow airlines to make appropriate plans for investments in personnel and equipment. Although requiring and linking an operational evaluation program, a phased compliance schedule, and an extended deadline places additional responsibilities on each affected party, this approach spreads economic burdens more equitably than other possible options and provides maximum safety benefits.

PART III—CONCLUSIONS AND OPTIONS

I think all of us have to acknowledge somewhere that while having safety legislated is not the ideal way to go, the fact . . . that Congress set a deadline has been a very significant piece of this program, and . . . for that, I think we owe the Congress a thanks.—*Robert Buley, Northwest Airlines, OTA Workshop*

THE ISSUES

The basic issues associated with TCAS II legislation include the safety, technical, and economic consequences of rapid installation—by 1992—in the Nation's commercial fleet. All three are interrelated; however the safety and technical issues are so closely connected that they will be summarized together. A fourth issue is the impact on international relations.

Safety and Technical Issues

The safety concerns related to TCAS II are twofold: (1) the as-yet-unknown effect of full TCAS II implementation on system safety, and (2) the possibility of reduced safety because resources are strained or diverted from other maintenance needs in order to implement TCAS II by December 30, 1991. FAA has not developed a well-defined plan for evaluating operational performance in a setting that includes a substantial portion of the Nation's fleet equipped with TCAS II. The limited installation programs undertaken to date have involved no more than two commercial aircraft and did not provide an adequate assessment of the effects of a fully-equipped fleet on the air traffic system. TCAS II technology is now well developed, and a more widespread operational evaluation is justified to determine whether software or hardware modifications are called for or whether pilot or air traffic control procedures must be changed. Without such a program, a worst case scenario is that the airlines would completely outfit their fleets only

to learn that a technical problem requires major modification of TCAS II equipment. A structured evaluation program would allow most problems to be identified quickly, preventing further installation of flawed units and permitting equipment modifications to be made early in the installation program.

A successful operational evaluation would require a critical mass of aircraft to be outfitted with TCAS II at an early date. Operations under the evaluation should cover the full spectrum of geographical locations and aircraft and airspace types, including sufficient numbers at hubs to address high-density issues and assess the impact on air traffic controllers in heavily used airspaces. The effects of TCAS II on pilot and controller performance are still unknown and must be carefully analyzed during the evaluation.

Regardless of the results of an evaluation period, airlines are aware that some upgrades to TCAS II will probably occur over the next 30 months, and they may postpone taking delivery of TCAS II equipment until near the installation deadline. This would permit airlines to avoid possible costs associated with removing TCAS and installing a modified version, but it would confront equipment manufacturers with serious cash flow problems. Moreover, this also means the air traffic system could suddenly be saturated with new equipment, and the resulting effects on the system are virtually impossible to predict.

Supplies of skilled labor, as well as ramp and hanger space, are limited. Thus, airlines may need to divert maintenance attention from other programs to install TCAS II on time. These strains on resources could degrade the quality of both TCAS II installations and other important maintenance and safety activities, such as those associated with aging aircraft.

Economics

The economic consequences of the implementation deadline will affect each airline differently. TCAS II installation would be least disruptive for airlines if it could be accomplished during the normal heavy maintenance cycle that occurs about 4 years for each aircraft. However, the December 1991 deadline leaves the airlines only 2 years for fleetwide implementation, because production equipment of TCAS II will not be available until December 1989. To complete the work in 2 rather than 4 years will require airlines to hire additional labor, schedule more overtime, and take more aircraft out-of-service time. The increased workload may cause sequencing problems with other programs, such as aging aircraft requirements and windshear equipment installation. Airlines that are financially healthy are much better able to meet these demands than airlines with cash flow or labor problems.

Out-of-service time for aircraft raises equity issues for the various airlines. Some of these equity issues are separate from the direct costs of installing TCAS II. Airlines without any extra aircraft may have to eliminate some flights for short periods. These airlines are likely to lose passengers to other airlines, whereas companies that have extra aircraft in their fleets or the resources to lease them can avoid canceling any service. In addition, some communities served by airlines without extra aircraft may be inconvenienced during down time for the aircraft that normally

serve them. Finally, the costs associated with the multiple maintenance requirements now in place may cause some airlines with older fleets to retire aircraft rather than complete the programs, further compounding out-of-service problems.

Airlines that do not meet the deadline for any reason will be penalized severely if unequipped aircraft are not permitted to fly in U.S. airspace in 1992. However, airlines that complete TCAS II installations on time will face substantial indirect cost penalties if their competitors do not commit similar resources and are granted extensions. If problems occur in early 1992 and TCAS equipment should need to be modified, all airlines will face substantial costs.

The TCAS II installation requirement has a different effect on the various U.S. TCAS manufacturers. Expecting over 6,000 orders from domestic and foreign airlines by the end of 1991, these companies have invested accordingly.[50] Under the current schedule, airlines may postpone taking delivery of equipment until late in 1991 to allow modifications to be made before their purchases are effective. Equipment manufacturers that were not early supporters of TCAS II development may reap benefits from such postponements, while those that invested heavily in development and testing programs will face cash flow problems as they gear up for production. A simple extension of the deadline could heighten cash flow problems by further postponing purchases.

International Issues

Foreign airlines contend that the installation of collision avoidance systems in international air transports should occur on the basis of agreed international standards and recommended practices. Such standards are under consideration in the International Civil Aviation Organization and are currently scheduled for adoption in 1990. Many question the appropriateness of the United States action in including foreign carriers within the scope of its TCAS II requirements, claiming this undermines the basic objectives of ICAO in producing international standards. Moreover, critics claim the United States may have abrogated Article 37 of the Convention on International Civil Aviation by its actions.[51]

An extended TCAS II implementation schedule could help ensure that U.S. and ICAO standards are compatible. If international airborne collision avoidance standards are completed and approved as expected by mid-1990, an international implementation schedule can then be established.[52]

CONCLUSIONS AND OPTIONS

OTA concludes that the TCAS II compliance deadline established in Public Law 100-223 (TCAS section) has some safety, economic, and international consequences not fully foreseen at the time of enactment. The TCAS II requirement is unique in the combination of technological complexity, rapid implementation, and the number of aircraft affected. Moreover, the extensive maintenance requirements associated with the aging of the national fleet were not an-

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[50] Joe Wilson, Bendix/King, personal communications, Feb. 7, 1989.
[51] Office of Technology Assessment, op, cit., footnote 7.
[52] M. Parkes, Civil Air Attache, British Embassy, in ibid.

ticipated when the legislation was enacted. Maintenance for aging aircraft will place severe demands on airline personnel and facilities resources concurrently with those needed for TCAS II.

Different groups concerned with aviation matters recognized some or many of the issues summarized in this report several months ago. Three possible congressional approaches were being discussed as OTA began this study in October 1988. The tradeoffs associated with each option are discussed below and summarized in Table 1 at the end of this section.

The first option was a signal from the congressional leadership that Public Law 100-223 would remain unchanged, thus ensuring rapid implementation of TCAS II. The signal would be necessary because uncertainty over whether Congress will make any change has led some airlines to postpone planning and committing resources to TCAS II. These airlines are likely to find that facilities and personnel are unavailable once they do begin to prepare for TCAS II, since both types of resources have already been committed. An early decision by Congress not to reconsider the legislation can minimize, but not eliminate economic penalties for some of the industry groups. If the current deadline is clearly confirmed, airlines will not gamble on an extension and delay implementing TCAS II.

However, OTA finds a critical and immediate need for FAA and the airlines to define and undertake an operational evaluation program. The current deadline does not appear to allow adequate time for this, given the constraints on certification, production, and installation capabilities.

The second option included explicit indication by congressional leaders that the deadline in the law was not going to be changed and that Congress encourages FAA's vague plans for a TCAS II transition program. However, even if FAA and industry tried to undertake a more well-defined transition program during late-1990 and early-1991, the deadline under this option does not allow time for adequate evaluation. Delays are likely during the certification process, which is complicated enough that it is likely to strain both industry and FAA resources, limiting the capabilities for evaluation. Further, since some airlines may fail to meet the current deadline, FAA would have to exercise its authority to grant exemptions under this option as well as under option one.

Moreover, under any circumstances, OTA finds that the input of air traffic control personnel to the TCAS II program must be stepped up considerably from its level to date. Full participation by FAA air traffic control personnel is an essential component of any evaluation. The effects on the air traffic system must be assessed, including the reactions of pilots and controllers to TCAS II, and any initial problems resolved, so that the full benefits can be realized.

Furthermore, and regardless of any decision on the deadline, Congress may wish to ensure that FAA has adequate resources for the installation period. These will be necessary for the Agency to evaluate TCAS and maintain adequate oversight of other airline maintenance and modification programs to prevent possible safety diminution indirectly related to TCAS II requirements.

The third option included amending the law to extend the deadline and encouraging an unspecified operational evaluation. (This was basically the airline industry's position.) In the view of both domestic and foreign airlines, the implementation deadline is the most pressing TCAS II issue. However, OTA concludes that if the deadline is extended with no other specific, required actions, most TCAS II safety benefits will be delayed, and equipment manufacturers will be severely penalized.

Yet, the present TCAS II implementation requirement is extremely difficult for some segments of the industry. Aircraft that cannot easily be fitted with TCAS II because of technical problems, such as some older commuter turboprops, would probably require extensions without a longer installation period. Moreover, the unilateral U.S. action in requiring TCAS II equipment of foreign airlines has created ill feelings around the world. Many foreign carriers are likely to install TCAS II voluntarily for safety and competitive reasons, once ICAO standards are established. Extending the deadline could ease international concerns and help synchronize ICAO's activities with U.S. requirements.

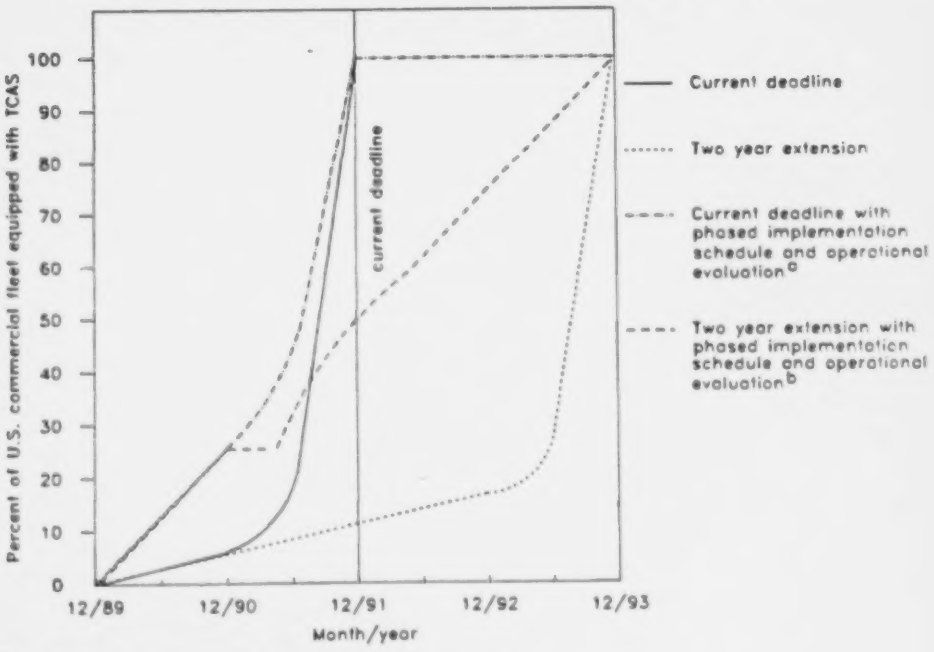
As OTA's study neared completion, a fourth option emerged—amending Public Law 100–223 to require a phased implementation schedule beginning in 1990 (to ensure early equipage of a substantial portion of the fleet) and a structured operational evaluation program, as well as extending the deadline. This would allow manufacturers to incorporate any necessary modifications before airlines took delivery of the balance of their orders. Sufficient airline resource limitations, economic inequities, and international implications stem from the present deadline for Congress to consider extending the installation schedule. OTA finds that the fourth option is the best choice and that aviation safety will be best served by introducing TCAS II on commercial aircraft as soon as possible, by requiring a phased implementation schedule, and by providing for a structured evaluation program carried out jointly by industry and FAA to oversee the first year of operation.

Prompt congressional consideration of any change to the law is important. OTA finds no reason to delay initial TCAS II implementation; yet, the forcing effect of legislation may well be necessary to ensure maximum safety benefits as early as possible and allow airlines to make appropriate plans for investments in personnel and equipment. Requiring and linking an operational evaluation program, a phased compliance schedule, and an extended deadline (the fourth option) will place additional responsibilities on each affected party, but it spreads the burdens more equitably than the other options.

OTA concludes that introducing TCAS early into a substantial portion of the commercial fleet and requiring a structured evaluation program conducted jointly between FAA and industry could ensure early safety benefits. Industry officials at OTA's workshop indicated that such an evaluation program might include a requirement that airlines purchase and install TCAS II equipment in 15 to 30 percent of the national fleet (600 to 1,200 aircraft) as soon as possible after production equipment is available (probably over the period from late spring to the end of 1990). The operational evaluation would be conducted over this time period, with the specific de-

tails and responsibilities to be worked out jointly under industry leadership. Congress could further require that 50 to 60 percent of the national fleet be equipped by the end of 1991 and fully equipped by the end of 1992 or sometime 1993. For an indication of the percent of the U.S. commercial fleet equipped with TCAS II over different time period options, see figure 7.

Figure 7.—U.S. Fleet Equipped with TCAS and Possible Timing Options



[a] Time constraints with a 12/91 implementation deadline do not permit an installation level off during the operational evaluation and analysis.

[b] This curve suggests only one of several possibilities.

SOURCE: Office of Technology Assessment.

This combination of requirements and an extended deadline offers the opportunity for early identification of any technical and human factors problems during the operational evaluation. It also addresses economic and international issues more completely than simply extending the deadline. A phased compliance schedule balances greater safety from more TCAS II-equipped aircraft early in the program against a more lengthy period for full implementation. It minimizes the downside of a more flexible deadline for the TCAS II manufacturers by ensuring more early orders and permits identification of system safety effects and timely corrective actions.

An operational evaluation program also offers the airlines the equivalent of an insurance policy. For the relatively modest extra cost of early installation in portions of the fleet and analytical support, the industry and public gain peace of mind if TCAS II works well, and avert financial and safety penalties if TCAS II should need to be modified. Regardless of how well TCAS II works, early implementation and evaluation bring the most TCAS safety quickly to the public.

COLLISION AVOIDANCE SYSTEM EQUIPMENT AND COMPLIANCE DEADLINES

THURSDAY, MAY 4, 1989

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON AVIATION,
COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION,
Washington, DC.

The committee met, pursuant to notice, at 2:47 p.m., in room 2167, Rayburn House Office Building, Hon. James L. Oberstar (chairman of the committee) presiding.

Mr. OBERSTAR. The Subcommittee on Aviation will please come to order.

Our hearing today is on issues involving the installation of legislatively mandated, collision avoidance technology aboard air carriers. About a year and a half ago, the Congress directed regulations to require that the fleet of our domestic carriers be equipped with the traffic alert and collision avoidance system, known affectionately as TCAS, and that this be done by the end of 1991 calendar year.

The testimony today will indicate that the compliance schedule should be phased in, that the deadline should be extended and that a fairly large-scale operational testing effort and evaluation period be undertaken to evaluate and test and assure that the first 700 TCAS units can be installed and operate as anticipated.

The Office of Technology Assessment, on request of the Congress, has completed a report on this subject, and we will receive that report in testimony and hear OTA's evaluation of the TCAS and the complexities and problems of its installation.

We will also hear from the airline industry, which is very clearly concerned. A, they want to be sure that they are installing aboard aircraft the best, the most effective safety technology; but B, they also want to be sure that it's going to work, that they don't experience the problem similar to the ground proximity warning system installation which proceeded at a very rapid pace and which ultimately had some problems.

We will have testimony from the Federal Aviation Administration on their views on the technology, their assessment of how it performs to date in tests, whether indeed there is justification for extending that deadline and, if so, under what conditions and with what restraints.

It is going to be a very compact and intensely technical, and of course as all these issues are, laced with economic overtones, hearing. And I look forward to all the expert testimony that we will be receiving today. We are going to take some time to digest it and

evaluate it. It is a very important matter we want to approach with only the greatest care and diligence.

It is not a new subject matter for either our ranking member, Mr. Clinger, or me. We dealt with these issues of aviation safety extensively in our joint efforts on the Subcommittee on Investigations and Oversight. I think together in our new roles in the Aviation Legislative Subcommittee we bring to this issue a background of considerable experience and understanding and sensitivity to the complexities on all sides.

And I think we also bring to this issue first and foremost an understanding of that opening paragraph in the Federal Aviation Act of 1958 that enjoins the highest possible degree of safety on the industry and upon the FAA, not safety at the margin, not only that safety which we can afford, but the highest possible degree of safety.

With those remarks, I yield to my colleague from Pennsylvania, Mr. Clinger.

Mr. CLINGER. Thank you very much, Mr. Chairman. I am delighted to join with you in this hearing today.

As we know, earlier today, the full committee focused on the issue of improving safety that we are going to be discussing here again this afternoon. But there we were talking about safety of airline passengers from terrorist attacks. Now we are discussing another aspect of airline safety, that being the safe separation of aircraft in an increasingly crowded airway system.

The comprehensive public record has already been pretty well developed on the promise of TCAS II equipment. Indeed, laws predicated on previous technological developments have been enacted that mandates the installation of this equipment on aircraft at the soonest practicable time.

This afternoon we will be hearing from our witnesses about the maturity of the TCAS II, their experience with it to date, and whether in their opinion—and I suspect we may have some difference of opinion on this—but whether in their opinion we should proceed with its installation and operation on all commercial aircraft and, if we were to proceed, over what time period should that process take place; in other words, how much time would be allowed to make the improvements.

Because the safety improvements that are offered by TCAS II are really significant if it performs as advertised, I think it would make a very profound improvement in safety. However, I think we have to be cognizant that if the system is imperfect and if it doesn't meet our expectations, then TCAS may actually present a real danger to its users.

For instance, if TCAS begins to issue false positives, false traffic advisories or resolution advisories to pilots on a regular basis, experience shows they will lose confidence in the system, will not rely on it, will not pay attention to it, may indeed even turn it off.

I think we also have to consider the ramifications of pilots responding to resolution advisories and how their actions may impair the ability of air traffic controllers to maintain adequate separation. And that really has not been a subject of any of the testing that has gone on so far as is how this system will operate over a congested airport.

We must be absolutely certain that TCAS is mature, that it receives valid operational field testing, and that pilots and air traffic controllers alike hold the system in high confidence and are willing to rely on it and to put themselves and their passengers in reliance upon it.

So, I look forward to hearing from our witnesses.

I particularly want to recognize our colleague, Mr. Packard, who has been a real leader in this whole effort as the architect of the bill we will be considering, and just want to commend him for his leadership and his very thoughtful contribution to this whole area.

Thank you, Mr. Chairman.

Mr. OBERSTAR. I would like to place in the record at this point statements received from Representatives Hammerschmidt and Inhofe.

[The prepared statements of Mr. Hammerschmidt and Mr. Inhofe follow:]

STATEMENT OF HONORABLE JOHN PAUL HAMMERSCHMIDT
FOR THE HEARING ON THE TRAFFIC ALERT AND
COLLISION AVOIDANCE SYSTEM (TCAS)
THURSDAY, MAY 4, 1989
1:30 p.m. -- ROOM 2167 RAYBURN

MR. CHAIRMAN:

FOR MANY YEARS, THE GOVERNMENT AND THE AIRLINES HAVE BEEN LOOKING FOR A WORKABLE COLLISION AVOIDANCE SYSTEM. IT APPEARS THAT WE FINALLY HAVE ONE. IT IS THE TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM, COMMONLY KNOWN AS TCAS.

TWO YEARS AGO, FOLLOWING THE LEAD OF OUR COLLEAGUE RON PACKARD, CONGRESS APPROVED LEGISLATION SETTING DEADLINES FOR THE INSTALLATION OF TCAS ON COMMERCIAL AIRCRAFT. IT REQUIRES THEM TO INSTALL TCAS ON THEIR AIRCRAFT BY THE END OF 1991.

HOWEVER, MORE RECENTLY, DOUBTS HAVE BEEN RAISED ABOUT THE WISDOM OF THIS DEADLINE. THE AIRLINES POINT OUT THAT, SO FAR, TCAS HAS BEEN TESTED ON ONLY 1 OR 2 AIRCRAFT AT A TIME. IN THAT LIMITED TEST, THE SYSTEM SEEMED TO WORK QUITE WELL.

BUT WHAT WILL HAPPEN WHEN THERE ARE DOZENS OF PLANES FLYING AROUND WITH TCAS? HOW WILL THEY ALL INTERACT WITH EACH OTHER AND WITH THE AIR TRAFFIC CONTROL SYSTEM?

ONE CONCERN IS THAT THERE COULD BE A LOT OF FALSE ALARMS. IF THE TCAS STARTS GIVING FALSE ALARMS, IT COULD BECOME LIKE "THE LITTLE BOY WHO CRIED WOLF." THE DANGER IS THAT PILOTS WOULD COME TO IGNORE THE WARNINGS AND A TRAGEDY WOULD OCCUR WHEN ONE OF THE WARNINGS TURNED OUT TO BE TRUE.

SO THERE IS A GENERAL CONSENSUS THAT THE SYSTEM MUST BE FULLY TESTED AND ALL THE BUGS WORKED OUT BEFORE TCAS COMES INTO WIDESPREAD USE. THIS VIEW WAS REINFORCED BY THE RECENT REPORT OF THE OFFICE OF TECHNOLOGY ASSESSMENT (OTA). OTA CALLED FOR THE PHASED IMPLEMENTATION OF TCAS AND AN EXTENSION OF THE INSTALLATION DEADLINE SO THAT THERE COULD BE AN OPERATIONAL TEST OF THE SYSTEM.

I AM PLEASED TO NOTE THAT MR. PACKARD HAS AGAIN TAKEN THE LEAD ON THIS ISSUE. HE HAS PROPOSED LEGISLATION THAT WOULD IMPLEMENT THE RECOMMENDATIONS IN THE OTA REPORT. I REALIZE THAT THERE MAY BE DIFFERENCES OVER SOME OF THE NEW DEADLINES SET OUT IN THAT LEGISLATION.

BUT I THINK THERE IS GENERAL AGREEMENT THAT SOME MODIFICATION OF THE CURRENT LAW IS NECESSARY. I INTEND TO CAREFULLY REVIEW THE TESTIMONY HERE TODAY AND HELP THIS COMMITTEE COME TO A RESOLUTION THAT WILL BE IN THE BEST INTERESTS OF AIRLINE PASSENGERS.

Opening Remarks
The Honorable James M. Inhofe
Subcommittee on Aviation
Collision Avoidance System Equipment and Compliance Deadlines
May 4, 1989

Mr. Chairman, I want to commend you for calling this hearing today, and I look forward to prompt consideration of the legislation I am confident will result from it.

Installation of TCAS II on airliners is a major step towards improving the safety of our air transportation system. Although flying is already the safest way to travel, we are always looking for ways to make it even safer, and TCAS II offers that promise.

In proceeding with this new air collision avoidance system, however, it has become clear that the 1991 legislatively mandated installation deadline is not realistic. Furthermore, it poses a possible threat to safety. TCAS II is a major innovation that changes the way pilots and air traffic controllers work together. It should be phased in in an orderly manner, with a real opportunity to evaluate it and make any adjustments that may be needed.

To understand the need for a phase-in, one need only visualize a busy airport, like D.C. National, at peak hour, with several pilots at any one time receiving traffic advisories and resolution advisories and taking the action indicated. In the meantime, the air traffic controllers are trying to guide aircraft in and out of the airport safely--but how do they deal with aircraft that change altitudes without the controllers' foreknowledge or control. The potential for problems is clear, and it's imperative that we implement TCAS II in such a way as to avoid them.

In addition, the current schedule just isn't feasible given the time required for installation, the number of aircraft affected, and the maintenance capacity available to do the work. We don't have the capacity or the trained manpower to install TCAS II within the current deadline. We certainly would not want to have to turn to foreign repair stations to fill the gap, even if they were available.

The TCAS II system is an excellent system with great potential to increase the safety margins in flying. But we have to make sure it is implemented in a safe and responsible manner. That requires extending the current deadline for 100 percent installation until 1993, with a phase-in over that period and an opportunity to conduct an effective evaluation of the system's performance.

Thank you, Mr. Chairman.

Mr. OBERSTAR. I thank the gentleman for his comments.

Are there other members who wish to make opening remarks?

[No response.]

Mr. OBERSTAR. If not, the Chair would recognize our colleague from his committee, the gentleman from California, Mr. Packard, who acted very decisively during the time. He was really concerned before and decisively so after the Cerritos incident and has been long an advocate of technology to resolve the problems facing us in aviation.

He has been a real student of this issue before us today, and it was his amendment that set in motion—his bill, rather—that set in motion the amendment to the legislation reported out of this committee over a year and a half ago which has resulted in the activities being undertaken with respect to TCAS.

So, the father of the TCAS timeframe and timeline, the gentleman from California, Mr. Packard.

TESTIMONY OF HON. RON PACKARD, A REPRESENTATIVE IN CONGRESS FROM CALIFORNIA

Mr. PACKARD. Thank you, Mr. Chairman.

Mr. OBERSTAR. We are glad to have you here. Thank you for the time and effort that you have devoted to this issue.

Mr. PACKARD. Thank you, Mr. Chairman. You are very generous.

It is a pleasure to appear before the subcommittee, and I appreciate you and the members of the subcommittee not only calling this hearing but participating in it.

I would ask unanimous consent that my full statement—and I will certainly try to be brief this afternoon—but that my full statement be entered in the record.

Mr. OBERSTAR. The gentleman's statement, without objection, will be included in the record in full.

[The prepared statement of Mr. Packard follows:]

STATEMENT OF
THE HONORABLE RON PACKARD
CONGRESSMAN, CALIFORNIA 43RD DISTRICT
BEFORE
THE HOUSE AVIATION SUBCOMMITTEE
MAY 4, 1989

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MR. CHAIRMAN, MEMBERS OF THE COMMITTEE, THANK YOU FOR THE OPPORTUNITY TO ADDRESS THE SUBCOMMITTEE CONCERNING THE OFFICE OF TECHNOLOGY ASSESSMENT (OTA) REPORT ON TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS). I ALSO WANT TO THANK YOU FOR INCLUDING IN THE HEARING H.R. 2151, A BILL I INTRODUCED TO AMEND THE TCAS IMPLEMENTATION DEADLINE INCLUDED IN LEGISLATION ENACTED LAST CONGRESS (P.L. 100-223).

AS YOU KNOW, I INTRODUCED LEGISLATION IN THE 100TH CONGRESS TO REQUIRE THE INSTALLATION OF THE TCAS ON ALL AIRCRAFT FLYING IN U.S. AIRSPACE WITH A CAPACITY OF OVER THIRTY SEATS. AS ENACTED, THE LAW REQUIRED A DEADLINE OF DECEMBER 30, 1991 FOR COMPLIANCE WITH THE TCAS REQUIREMENT. THE SAFETY BENEFITS TCAS AFFORDS THE AIRLINE INDUSTRY AND ITS PASSENGERS COULD NO LONGER WAIT. CONGRESS INTENDED THE TCAS REQUIREMENT TO FORCE THE FEDERAL AVIATION ADMINISTRATION (FAA) AND THE AIRLINE INDUSTRY TO TAKE IMMEDIATE ACTION TO INSTALL TCAS. AFTER THIRTY YEARS OF DEVELOPMENT AND GROWING CONCERN OVER MID AIR COLLISIONS, CONGRESS DEMANDED ACTION. AS THE SIZE OF THE COMMERCIAL FLEET GREW IN THE LAST TWO DECADES THE NUMBER OF NEAR MID AIR COLLISIONS HAS INCREASED. IN THE LAST THREE WEEKS, THERE HAVE BEEN TWO NEAR MISSES IN U.S. AIRSPACE. THUS, THE NEED FOR TCAS AT THE EARLIEST

POSSIBLE DATE GROWS GREATER EVERY DAY.

THE LEGISLATION THIS COMMITTEE INITIATED AND ENACTED DURING THE 100TH CONGRESS, P.L. 100-223, IS THE SUBJECT OF A VERY EXCELLENT REPORT BY THE OFFICE OF TECHNOLOGY ASSESSMENT (OTA): "SAFER SKIES WITH TCAS: TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM." I COMMEND OTA FOR THEIR FINE WORK AND AGREE WITH THEIR FINDINGS. THE FINDINGS OF THE OTA REPORT SUPPORT THE 100TH CONGRESS' OBSERVATION AND INTENT --

> "...AVIATION SAFETY WILL BE BEST SERVED
> BY INTRODUCING TCAS II ON COMMERCIAL AIRCRAFT
> AS SOON AS POSSIBLE,"

HOWEVER, OTA BRINGS TO LIGHT A NUMBER OF CONCERNS THAT WERE NOT RECOGNIZED AT THE TIME WE PASSED THE TCAS REQUIREMENT. THESE CONCERNS ARE --

> THE NEED FOR AN OPERATIONAL TEST AND EVALUATION (OTE)
>
> THE NEED TO INCLUDE A PHASED IMPLEMENTATION SCHEDULE
>
> THE NEED FOR SOME EXTENSION TO THE DEADLINE FOR COMPLETE IMPLEMENTATION

IN DECEMBER, PRELIMINARY INDICATION BY OTA SUGGESTED THAT THE DEADLINE ENACTED IN P.L. 100-223 COULD CAUSE UNANTICIPATED SAFETY, ECONOMIC AND OPERATIONAL PROBLEMS. SINCE THEN, I HAVE BEEN WORKING ON LEGISLATION TO ADDRESS THESE CONCERNS. IN THIS PROCESS, I SOUGHT AND CONSIDERED INPUT FROM THE AIRLINE INDUSTRY, AIRLINE PILOTS, OTA, FAA, AND FOREIGN CARRIER REPRESENTATIVES.

THEIR INPUT WAS MOST VALUABLE AND APPRECIATED.

THE BILL I INTRODUCED, H.R. 2151, IS BASED ON THE FOURTH POLICY OPTION CONTAINED IN THE OTA REPORT. OPTION FOUR SUGGEST THREE CHANGES TO EXISTING LAW --

1. REQUIRE A PHASED IMPLEMENTATION SCHEDULE BEGINNING IN 1990 (WITH A SUBSTANTIAL PORTION OF THE FLEET EQUIPPED WITH TCAS).
2. A STRUCTURED OPERATIONAL TEST AND EVALUATION (OTE) PROGRAM CONDUCTED WITH A SUBSTANTIAL PORTION OF THE FLEET.
3. EXTENDING THE DEADLINE REQUIREMENT.

H.R. 2151 CONTAINS ALL THREE OF THESE ELEMENTS. THERE IS COMPLETE AGREEMENT ON THE NEED FOR SWIFT ACTION AND ON THE NEED FOR AN OTE PHASE.

HOWEVER, THE TESTIMONY YOU WILL HEAR TODAY WILL INDICATE THERE ARE DIFFERENCES OF OPINION THAT HAVE NOT BEEN RESOLVED. THE MAJOR POINT OF CONTENTION IS THE LENGTH OF EXTENSION FROM THE CURRENT DECEMBER 30, 1990 DEADLINE. THE AIRLINE INDUSTRY WOULD LIKE A TWO YEAR EXTENSION. OTHERS WOULD LIKE THE EXISTING DEADLINE MET. MY BILL TAKES THE MIDDLE GROUND -- A ONE YEAR EXTENSION. THIS ONE YEAR EXTENSION SHIFTS THE ANNUAL INSTALLATION RATE REQUIRED TO MEET THE DEADLINE FROM APPROXIMATELY FIFTY PERCENT (50%) TO THIRTY-THREE PERCENT (33%) PER YEAR. THIS IS A SEVENTEEN PERCENT (17%) REDUCTION IN THE RATE REQUIRED TO MEET THE DEADLINE. THE TWO YEAR EXTENSION,

PROPOSED BY THE AIR CARRIES, WOULD MAKE AN ADDITIONAL EIGHT PERCENT (8%) REDUCTION IN INSTALLATION RATE. IF AIR CARRIES PROVE, AND CONVINCE THE MAJORITY OF THE COMMITTEE, THAT THIS EIGHT PERCENT (8%) WILL HAVE SIGNIFICANT IMPACT ON SAFETY AND MAINTENANCE OPERATIONS, I HAVE NO OBJECTION TO AMENDING H.R. 2151. HOWEVER, THE BURDEN OF PROOF LIES WITH THE AIR CARRIERS.

A SECOND POINT IS THE STRUCTURE OF THE OTE PHASE, IN PARTICULAR THE PERCENTAGE OF THE COMMERCIAL FLEET TO BE TCAS EQUIPPED IN THE FIRST OR OTE PHASE. THE OTA REPORT SUGGESTS BETWEEN FIFTEEN (15%) AND THIRTY (30%) PERCENT. AGAIN, I HAVE CHOSEN THE MIDDLE GROUND AND USED TWENTY FIVE PERCENT (25%). AS OTA HAS INDICATED, THE GREATER NUMBER OF AIRCRAFT WE HAVE EQUIPPED WITH TCAS IN THE OPERATION TEST, THE BETTER. ALSO, THE LENGTH OF TIME REQUIRED FOR THE OTE PHASE IS IN QUESTION. IT IS SUGGESTED THAT BETWEEN SIX AND TWELVE MONTHS IS ADEQUATE. I HAVE USED TWELVE MONTHS ANTICIPATING THAT THE OTE WILL NOT INTERRUPT INSTALLATION OF TCAS EQUIPMENT. RATHER, DURING THE OTE PHASE, ADDITIONAL AIRCRAFT WILL BE TCAS EQUIPPED AND ADDED TO THE AIR TRAFFIC SYSTEM. INTRODUCING GREATER NUMBERS OF TCAS AIRCRAFT TO THE AIR CONTROL SYSTEM WILL TEST THE CAPABILITIES OF THE SYSTEM TO HANDLE THE LARGER AND GROWING FLEET.

ALSO, OTA AND FAA SUGGEST COORDINATION, OR TIEING, TCAS AND WIND

SHEAR INSTALLATION SCHEDULES PROVIDES SOME ECONOMIC AND SAFETY BENEFITS. H.R. 2151 PROVIDES TO THE FAA ADMINISTRATOR THE FLEXIBILITY TO COORDINATE THE TWO REQUIREMENTS. THE CURRENT DEADLINE FOR THE WIND SHEAR EQUIPMENT IS JANUARY 4, 1993. ONLY FIVE (5) DAYS BEYOND THE NEW DEADLINE I PROPOSE IN H.R. 2151.

THE OTA REPORT ALSO SUGGESTS THE LANGUAGE OF P.L. 100-233 CREATES SOME PROBLEMS WITH INTERNATIONAL TREATIES AND AGREEMENTS. I HAVE INCLUDED IN H.R. 2151 A PROVISION FOR THE FAA ADMINISTRATOR TO WORK WITH FOREIGN CARRIES IN ORDER TO COMPLY WITH INTERNATIONAL OBLIGATIONS. ALSO, I WILL SUGGEST SOME REPORT LANGUAGE ON THIS MATTER.

MR. CHAIRMAN, I MUST MAKE ONE FINAL POINT. ANY CHANGE IN THE DEADLINE FOR THE TCAS REQUIREMENT SHOULD NOT SUGGEST TO ANYONE IN THE AIR LINE INDUSTRY THAT FOOT DRAGGING OR DELAYING ACTION ON TCAS INSTALLATION IS CONDONED. EVERY AIR CARRIER, REGARDLESS OF SIZE, SHOULD BEGIN IMMEDIATELY TO ACQUIRE THE EQUIPMENT AND THE MEANS TO MEET THE CURRENT OR NEW DEADLINE FOR TCAS INSTALLATION. THE ECONOMIC CONSEQUENCE OF DELAY ARE GREAT. HOWEVER, I DO NOT DETECT ANY NOTE OF SYMPATHY IN CONGRESS FOR THOSE CARRIERS THAT PROCRASTINATE ON TCAS.
THIS PLACE A BURDEN ON THIS COMMITTEE AND THE WHOLE CONGRESS TO ACT SWIFTLY. INDUSTRY MUST KNOW WHAT CONGRESS REQUIRES AND WHEN. THEREFORE, I TRUST WE WILL MOVE QUICKLY TO MARK-UP ON H.R. 2151. MR. CHAIRMAN, THANK YOU. I LOOK FORWARD TO TODAY'S TESTIMONY AND PARTICIPATION IN THIS HEARING.

Mr. PACKARD. Thank you, Mr. Chairman.

During the 100th Congress, we did pass into law TCAS legislation that required the installation of this new technology—not so new, really—by December 1991. And to my knowledge, no one has really changed their commitment nor their attitude on the usefulness of this very important technology. I think there is general agreement that if this equipment is installed on aircraft, it will certainly lend a significant improvement to the safety of our air travel.

Last year, after the bill was passed into law, there were some concerns, serious concerns, raised about safety, economic issues, and the maintenance problems and the scheduling that was in the law.

Congress requested the Office of Technology Assessment to conduct a study and to report on these concerns. OTA has completed that study and submitted a report. And among many other things, there are some very significant recommendations by the OTA report. And it is because of those recommendations that I have introduced H.R. 2151 as a follow-up of the TCAS legislation that was passed into law.

OTA did suggest some improvements in the law and gave us some recommendations from option 4, a phased-in implementation schedule rather than a finished schedule only, and that phased-in schedule they recommend coincide with wind shear installation detection equipment. The installation of that ought to parallel an operational test phase to be included in the process of retrofitting the equipment, and an extension of the deadline for completion. There are certainly some deep concerns by the air carriers particularly as to the deadline by 1991. They are asking that it be extended for 2 years.

I have submitted my legislation to extend and to make these other modifications. I have recommended in the legislation a 1-year extension rather than the suggested 2-year, by the air carriers.

However, I am not adamant on that position. I feel that my intent always has been to keep FAA and the air carriers and the manufacturers' feet to the fire, that we move as rapidly as we can reasonably do. That has been my position, and it still is.

So, if the committee and the subcommittee are persuaded by the testimony today from the air carriers and others that two years is more necessary and valid and a better schedule than the one year that I am recommending in the legislation, I would have absolutely no problem supporting that change of my legislation.

I am anxious that we do not require the airlines to take more aircraft out of service than is realistic and reasonable and at the same time I want them to move as rapidly as they are able to do.

So, that will be an important discussion today in the hearing, and as we mark up the legislation it will be an important as we look at amendments to see if, in fact, the 2-year extension is more palatable and more realistic than a 1-year extension.

Also, the phasing-in process, OTA recommended anywhere from a 15 percent to a 30 percent phase-in on the first year. And so I have included in the new legislation a 25 percent phase-in so that after one year 25 percent of the planes would be retrofitted with the equipment, and that would give us, I think, a fairly substantial

base upon which to determine the analysis of the system to see whether in fact there are other problems as we increase the numbers of this equipment in operation in busy airspaces.

Also that 25 percent may be modified if the committee feels that it is necessary, but certainly a quarter of the planes at the time we begin a study to determine the effects of the numbers would be, I think, a very helpful number.

As I have already mentioned, I do not object to making changes. I simply feel that it is time that we make a decision and allow the industry, the manufacturers, the air carriers, FAA, and others to know where we are going and what the time line is as rapidly as possible. The longer we delay the more frustration this creates in the entire process.

For that reason, I strongly urge that after this hearing we set a markup date and move this legislation as rapidly as we can and allow the industry to know what schedule they do have to live with and let them be on with the job of getting this equipment onto their aircraft.

That is all I have in my testimony today. And if there are questions, I will be more than happy to respond.

Mr. OBERSTAR. Certainly we do not want to prolong the gentleman's presentation, but does the gentleman, who has followed this matter very, very closely from a technology standpoint and approaches this issue from his own background of very considerable experience in electronics and technology, are you still persuaded that as the FAA felt two years ago in its testimony to this committee that with the entire airline fleet equipped with TCAS and with mode C transponders for smaller aircraft, the risk of midair collisions involving air carriers would be virtually eliminated?

Mr. PACKARD. I am more persuaded now, Mr. Chairman, than I was when we started the whole process of putting this into law.

Mr. OBERSTAR. Your concern does not go to the technology, to its efficacy, but to the installation, timing and phasing of installation?

Mr. PACKARD. That plus the untested arena of having many, many of these pieces of equipment operating in the same time in a given airspace. That, of course, is the reason for a review of the process in midstream of installing.

But as far as the efficacy of the equipment itself, I am more persuaded that it will do its job than I have ever been. All of the tests that have been conducted on the various airlines, Piedmont and United and Northwest, all the pilots that have used the test equipment have come back with glowing reports as to what it does for them in terms of in-the-cockpit information. And I have talked, since the tests were completed, with the manufacturers and the designers of the equipment, and they are more persuaded that they can address the detailed concerns and problems that will arise as we further test.

So, I am more persuaded than ever that it is going to work.

Mr. OBERSTAR. It's good to hear that because certainly I feel the same, and I just wanted to have you on record on that score.

Picking a word out of your previous statement, the "arena," the arena, I assume you concur, is principally the arena of the traffic control area, the TCA's where the TCAS is going to be the most significant. It is not en route as much as where you have the con-

gestion and the concentration of aircraft, small and large, as they enter the traffic control areas; correct?

Mr. PACKARD. I think that is correct, and that is all the more reason why a review at an appropriate time when many of these pieces of equipment are operating in a given TCA will be very valuable information. We are not asking—in fact, on the contrary, we are not expecting the airlines to stop the installation process during that review period, but simply to have enough pieces of equipment operating that we can conduct, I think, a useful and valuable review and still continue and then make modifications as that review may dictate.

Mr. OBERSTAR. My understanding is we will hear more on this in the testimony yet to be submitted. But the airlines, I understand, want a smaller sampling of the fleet. They would like it to be 15 percent rather than 30 percent.

Mr. PACKARD. I understand that also, and those two items, the end scheduled and the amount that needs to be done at the end of a given period of time, the 25 versus another percentage, are flexible. And the committee ultimately ought to make the decision on what they can live comfortably with, and I can live comfortably with what the committee decides.

Mr. OBERSTAR. We will focus on those issues and also on the end time. Your bill, recently introduced bill, provides a 1-year extension of time.

Mr. PACKARD. I felt it would be easier to move to a longer period of time than it would be to try to retract it back. And so that is why we submitted the 1-year period, recognizing that that could be altered at committee level and subcommittee level.

Mr. OBERSTAR. I thank the gentleman very much for his comments and responses.

The gentleman from Pennsylvania?

Mr. CLINGER. Thank you, Mr. Chairman.

And thank you, Mr. Packard, for your testimony and for your flexibility. As you have indicated, the purpose of this hearing is to determine what is realistic, what can be done and done in a way that will assure that once we get TCAS installed in the fleet that it is going to do the job that we expect it to do.

In that regard, it is my understanding that you would contemplate, and I think that we all contemplate, that while the more intensive testing is going to be a part of the next phase, testing in and around airport complexes, that the retrofitting of the aircraft will continue to go on. In other words, there is a lot of wiring and changing and so forth that needs to be done, so that we would not be losing time by virtue of having a more extensive testing period.

Mr. PACKARD. That is very correct. The box itself, the piece of equipment that goes into the cockpit of the aircraft, is not the major installation. It's the antenna and the wiring and much of that can be done even if we are making modifications in the TCAS equipment itself.

Mr. CLINGER. When we talk about the percentage of the fleet that would have to be retrofitted by a given time—and I gather that we want to make sure enough are retrofitted so we have decent sampling for the test to be conclusive—do you know what 15

percent would amount to, how many aircraft we would be talking about?

Mr. PACKARD. If I am not mistaken—and those that will follow with more expert testimony in this area—we have somewhat in the area of, what, 4,800? Fifteen percent would be 600. I thought we would have about 4,800 airplanes in service that would be required, but I may be off on that.

Mr. CLINGER. All right.

Mr. PACKARD. But I am told that 600 aircraft would be 15 percent, and approximately, I think it would be, 800-and-something, between 800 and 900 would be your 25 percent.

Mr. CLINGER. Okay. Well, we thank you very much.

Mr. PACKARD. One other comment, Mr. Chairman, if I may.

Mr. OBERSTAR. Yes.

Mr. PACKARD. That is that there is conflict in terms of within those that are affected by this legislation in terms of what an equitable and reasonable finished completion deadline would be. The airlines would like the two-year extension. The manufacturers of the equipment would like less, they certainly would like to see the one. The pilots would like to have it as tight as it can be.

And so again, the committee needs to make a decision as to what is the fairest and perhaps the most realistic final deadline without having to come back and readdress the issue in another year or two.

If there are no other questions, Mr. Chairman, that concludes my presentation.

Mr. OBERSTAR. Any other questions from colleagues?

[No response.]

Mr. PACKARD. Thank you.

Mr. OBERSTAR. Thank you very much, Mr. Packard. You may resume your customary position on the committee roster.

Our first witness is the analyst and expert and author of the OTA report, "Safer Skies with TCAS," who conducted a very extensive inquiry, Ms. Edith Page.

Ms. Page, welcome, and would you identify your associate?

TESTIMONY OF EDITH B. PAGE, TRANSPORTATION DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT, ACCOMPANIED BY KEVIN DOPART, PRINCIPAL ANALYST, OFFICE OF TECHNOLOGY ASSESSMENT

Ms. PAGE. I will.

Kevin Dopart, who was the principal technical analyst for OTA on this study, is accompanying me, and he will help address any of the more technical issues that are raised during the question-and-answer period.

Mr. OBERSTAR. I want to compliment you and OTA generally for the excellence of your work, the quality of the presentation made, and very fine analytical work accomplished with a very difficult subject. It is one which was accomplished with great skill and is a great service to the Congress.

Ms. PAGE. Thank you. With your permission, I would like to submit my full written testimony for the record and summarize more briefly.

Mr. OBERSTAR. Without objection, the entire statement will be included in the record at this point. We welcome you to proceed in any way you wish.

We will pursue this hearing and pursue all the testimony from witnesses notwithstanding the unavoidable delays caused by the vote at the outset of the hearing, and anticipate hearing all testimony this afternoon.

We will, unfortunately, though, I am sure, be interrupted by other votes on the budget resolution now pending on the House floor.

Ms. PAGE. It is a pleasure to appear before the subcommittee to share the results of our special report.

The report lays out several possible ways to increase collision avoidance protection for the flying public, and we did provide copies of the full report for members of the subcommittee if they desire further information.

I would like to take a few minutes right at the beginning to describe the process we used for this study because it was unusual in that we had a very tight deadline set by the Congress and that there was a good deal of disagreement focused on a set of narrow issues.

All segments of the aviation community cooperated fully during the course of our work, providing information and struggling together to develop a common solution for a number of difficult issues.

Throughout the study, FAA, the airlines, TCAS equipment manufacturers, pilots, maintenance specialists, and airframe manufacturers played key roles. They gave generously of staff time and effort to assist us through interviews, site visits, written comments, and responses to questionnaires.

In January, as the study neared completion, OTA held a workshop with representatives from all these groups to review our findings and to evaluate the policy options that appear in the testimony. In fact, it was toward the end of this workshop at OTA that a consensus emerged on what would become major findings of our report.

We have for your information at this time published a list of contributors and workshop participants, which can be found at the end of my written statement.

All told, this study represented an admirable cooperative effort, and I would like to express publicly OTA's gratitude to all those who helped us for their participation.

The TCAS II program is a complex combination of advanced technologies, a requirement for rapid installation, and impact on a large number of commercial aircraft. OTA concluded that aviation safety will be best served by revising the present program in three ways. These include requirements for:

No. 1, introducing TCAS on a number of commercial aircraft as soon as possible; No. 2, requiring a phased implementation schedule over a somewhat extended time frame; and No. 3, establishing a structured evaluation program to be carried out jointly by industry and the FAA to oversee the first phase of operation.

H.R. 2151, proposed by Congressman Packard, contains methods of addressing each of these.

OTA further concluded that there is absolutely no reason to delay initial TCAS II implementation and that major safety benefits would come from beginning installation as soon as production equipment is available.

However, we also concluded that airline resource limitations, economic inequities that affect airlines and equipment manufacturers and international implications make the present deadline, December 1991, extremely difficult.

In addition, the need for sufficient time for a reasonable evaluation program and for any necessary changes to TCAS or operating procedures led us to suggest that Congress consider extending the installation schedule.

Prompt action on any extension is important. I would echo Mr. Packard's remarks on that. The current uncertainty surrounding the deadline has made it difficult for all parts of industry to plan and allocate resources. If an extension is enacted, specific requirements are needed to ensure that installation begins promptly once equipment is ready and proceeds at a reasonable pace.

OTA's experience over the course of the study tells us that the forcing effect of legislation will be necessary to ensure safety benefits quickly for the flying public and to encourage airlines to make definite plans and commitments for personnel and equipment.

To date, only two commercial aircraft equipped with TCAS have been operated at any given time under the limited installation program. Pilots and others involved have been very favorably impressed with TCAS. In fact, Northwest Airlines has subtitled its TCAS progress report, which I have with me, "Takes the worry out of being close."

However, their enthusiasm is tempered by the knowledge that some uncertainties remain. How best to balance the need to resolve these uncertainties and to make reasonably sure that TCAS helps prevent another midair collision is the dilemma before the subcommittee.

We concluded that a larger percent of the commercial fleet, roughly 15 to 30 percent, or 600 to 1,200 aircraft, must be outfitted with TCAS II as soon as possible, say by December 1990, if that is feasible.

Data should be collected from the time the first few aircraft are TCAS-equipped. The interaction of pilots, controllers, and TCAS should be evaluated over a plateau period, or a time when installation is perhaps held in abeyance, of three to six months to determine whether additional equipment or procedural changes are called for. This could help address any changes that seem warranted due to the interaction between pilots and controllers that Mr. Clinger referred to.

In the meantime, airlines should continue to install racks and wiring in remaining aircraft for final installation of TCAS in a short period of time.

Participants at OTA's workshop indicated that probably no more than 30 percent of the passenger transports could be equipped with TCAS II in time for an early operational evaluation and that commuter aircraft would have additional and perhaps specific difficulties.

They further agreed that TCAS operating on 15 percent of the commercial fleet was the minimum number necessary to cover the spectrum of possible system effects; that is, the variety of airports and operating environments.

Industry and FAA will need to cooperate in developing an evaluation program that covers a range of aircraft and airspace types. All parties will need to allocate a share of the resources for collecting, analyzing, and disseminating data.

Full participation by air traffic control in FAA's evaluation program is extremely important, since the full effects of TCAS on pilot and controller performance remain unknown.

Congress may wish FAA to report periodically on progress toward developing and implementing the operational evaluation and on acting on its findings.

Furthermore, FAA will need to allocate sufficient staff and funds for these activities and may require contract support beginning late this year when aircraft equipped with the latest version of TCAS enters service. Provisions for these must be made in FAA's plans and budget.

OTA recognizes that requiring and linking an operational evaluation program, a phased compliance schedule, and an extended deadline places additional responsibilities on all parties. However, it is clear to us that this approach spreads responsibilities and economic burdens more equitably than other possible options.

Each of the limited operational evaluations to date have suggested procedural and equipment changes for TCAS, and FAA and industry have disagreed on which changes are critical to safety and should be required. A large-scale evaluation program may generate similar discussions.

It is incumbent upon those developing the evaluation to provide for ways to reach consensus on areas of disagreement.

Moreover, the extent of any changes necessary for TCAS or operating procedures will affect the feasibility of meeting the implementation milestones of that schedule. Congress may wish to make the deadline criteria flexible or give FAA authority to extend it if future events warrant that.

Thank you. And Mr. Dopart and I will be happy to answer your questions.

Mr. OBERSTAR. Thank you very much, Ms. Page, for the fine summary of your more detailed prepared statement, again which summarizes, I thought, rather fairly your complete report. It is almost unreasonable to ask you to condense into what has been a 6- or 7-minute presentation the results of months of investigation and inquiry into so complex an issue, yet you have done that with great skill.

We have a vote in progress on the floor. Let me get through a few questions and we can break shortly after the second bell.

What does "prompt" mean? What is your view? I am trying to get a sense of timing here. Let's see, you say on page 2, "Prompt congressional consideration of changes is important," and then if the extension is enacted we need specific requirements in the law to assure that installation of TCAS would "begin promptly after production equipment."

Therein lies perhaps scattered a few million dollars. [Laughter.]

Ms. PAGE. You are correct about that, and it is a question of who bears some of the responsibility for producing those millions. That is the reason for my perhaps seeming to hedge.

The schedule that suggests installing the equipment in 30 percent of the fleet by 1990 supposes or assumes that everything goes pretty much like clockwork throughout the installation and the final testing, acceptance testing, that is still under way at the FAA technical center in Atlantic City.

The manufacturer's equipment is about to be tested, I understand, and then the line pilots will be flying test flights with the equipment in, I believe that is scheduled now for June. If all goes well, they could probably install, have production equipment approved during the course of these tests and begin installing for an unlimited evaluation program early in 1990.

Mr. OBERSTAR. All right. Now, I was really going to work that issue, that question in reverse.

Ms. PAGE. Sorry.

Mr. OBERSTAR. But you handled it very well and gave me at least part of the answer.

The question I have is production line. You used that line, and it's very important. We know very well that prototype is the kind of equipment that is tinkered with and adjusted, and you know, it may itself be the gold-plated model and the perfect unit. Once you take that model, though, and put it into a production line setting, you may have a very different piece of equipment coming off the other end.

So, how difficult is it going to be to put this complex technology into a production line setting and when you have, say, three—i think that is what the number is—three potential manufacturers, production-scale manufacturers of this equipment?

Ms. PAGE. You are correct, there are three manufacturers. In fact, orders have been placed with each of the three by major carriers.

It will not be extremely difficult to put the production line equipment into—put the production lines into action once the tests have been completed. The prototype equipment is now at a point where the equipment that is being flown in these tests is, it is hoped, extremely close to what will be the production line equipment.

So, once the test flights are concluded, they will be able to proceed with producing the equipment. And the best estimates we have been given by the manufacturers is that they expect that to be December 1989 or January 1990.

Mr. OBERSTAR. December 1989 or January 1990 to begin production?

Ms. PAGE. They will have the first units coming off the production line at that time.

Mr. OBERSTAR. Production line?

Ms. PAGE. That's right.

Mr. OBERSTAR. Operation?

Ms. PAGE. That's right.

Mr. OBERSTAR. How long does it take from circuit board and framework to assemble one of these outfits?

Ms. PAGE. Kevin, do you know?

Mr. DOPART. No, I do not know. But we were told by each of the manufacturers that they could meet the needs of all the airlines within the 2-year period. As a matter of fact, at least one manufacturer told us it could meet the whole needs of the airline industry in the 2-year period.

Mr. OBERSTAR. One manufacturer alone would be able to produce roughly, what, 4,000 units?

Ms. PAGE. Yes.

Mr. DOPART. That's correct.

Mr. OBERSTAR. When the unit is produced—and I am sure my colleagues who are now going off to vote one by one; I am losing them like Hayden's Symphony 104—there is a big difference from one production center to another. There is an awful lot of quality assurance that is needed along the way for something so delicate and so sophisticated as this.

Do you have a sense of how long and what kind of inhouse testing before you have to put these units on? For example, the DOSE units, altimeter reading units, they have to operate on a shelf for a period of time before they can be certified. They have to run continuously and see whether there is anything internally that is going to break down.

Ms. PAGE. That kind of testing has been ongoing for a lengthy period of time, and at least one of the manufacturers has had demonstration units—well, I would say all of the manufacturers have had demonstration units in their fleet planes that they have flown a number of people in, and the equipment that they have in those planes is always their latest model.

They took—Bendix—took OTA staff up to fly some encounter with their latest unit, and it was a very exciting trip. And I think we can feel assured that the testing that they have done is at a point where we can operate that with confidence. The limited installation programs bear that out.

Mr. OBERSTAR. Well, the reason I ask the question is that if the end date is extended by 1 year or 2 years and then other timeframes change within the overall time line—and I just wanted to get a fix on the production timeframe and time lag in testing production units and making sure that they are going to meet the standards set in this demonstration phase. And you have given me some idea of the answer to that question.

We do have a vote in progress, and the committee will stand in recess for approximately 10 minutes.

[Recess.]

Mr. OBERSTAR. The subcommittee will resume its sitting.

What is your judgment of the impact of a 1-year compliance extension as compared to a 2-year extension? Who benefits, to what extent; can we put a price tag on that, on the value, if any, of that extension of time?

Ms. PAGE. I will defer to the ATA for the price tag. They have made a considerable effort at collecting that kind of information, and they will be speaking with you later this afternoon.

A 1-year extension, if a firm cutoff point of the 1 year is retained, could provide difficulties if all of the testing and the installation does not go perfectly.

We were assured by the airlines that they would meet any deadline Congress set. However, we all know that testing programs and evaluation programs do not usually go flawlessly. It is important to permit time to evaluate the operation of TCAS when there are more airplanes in the air that are equipped with it.

And I would—the short answer is—I would be perfectly comfortable with the 1-year extension, provided that there was flexibility for extension of that for an additional 6 months to a year if the results of the operational evaluation indicate that that is necessary.

Mr. OBERSTAR. You are recommending, in effect, then, putting some regulatory authority in the hands of FAA under some restrictive guidelines for extension?

Ms. PAGE. I think that would be a prudent course. We, as I said in my written testimony, we agree with what Mr. Packard said, that the forcing effect of legislation is going to be a very important factor in keeping the program moving on a regular basis. We want—everyone wants—that installation to begin soon, and keeping a rather tight deadline as the goal is one way of doing that.

However, the purpose of the operational evaluation is to identify problems that might exist when there are a number of airplanes, aircraft, in the air. And if there are problems that develop, then there will be time needed to correct them, and that is the purpose of providing some flexibility in perhaps a second year.

Mr. OBERSTAR. I am for flexibility, but on a very short leash in matters of this kind, to be very candid.

Before I go on to other members, just one very difficult question to answer:

What is the cost benefit in human lives? Or perhaps otherwise put, what is the risk to human lives of a 2-year extension of time?

Ms. PAGE. I am going to ask Kevin to answer that. He did a good deal of work for our earlier report, "Safe Skies for Tomorrow," on the types of accidents that have occurred, and he can give you a good evaluation of that.

Mr. OBERSTAR. Mr. Dopart?

Mr. DOPART. Edith may be giving me more credit than I deserve.

The first step in dealing with the risk of midair collision, it is a very, very low risk statistically. But it is a major concern, and it is something we can do something about with TCAS and air traffic control considerations.

In our recommendations in the report, we believe TCAS worked well enough that bringing it in early would add some initial benefits up front where we can be assured that it will work well within the whole system.

The concern that we had, and of those that participated in our workshop, was that if there should be a problem and you have to reconfigure TCAS, if you don't have that operational evaluation, it may come to the point where you have to shut them all off, take 6 months down, and then redo it all.

By having the evaluation program and an extension, you get some benefits early and learn if there is a problem, you will get the full safety quicker.

The 2-year extension is not an extension—I don't want to extend this out too long—in that there wouldn't be any TCAS. You would be getting TCAS through the whole period. So, you are getting benefits early, and it is likely that the airlines would install TCAS on the short-haul airplanes first for the operational evaluation. And those cover probably more than 50 percent of all flights. So, you would be handling the majority of your passengers early on in that program.

Ms. PAGE. Mr. Chairman, you have asked a question that is really a tough one to answer. Kevin is right. We assume that in designing the operational evaluation program, they would install in those densely used airspace so that those are the places where statistically the risk of collision is highest. So, if you put those in first, then you would have the benefits for that type of airspace.

However, I want to say that you can never predict where one of those collisions is going to occur. And we felt that a two-year extension with early installation in those densely crowded airspaces would provide a good margin of safety so that you would reduce the otherwise steady risk of a midair collision substantially and not run an extra risk by extending two years.

Mr. OBERSTAR. Thank you. That is admittedly a difficult question, but it is one that we need to mull over.

Ms. PAGE. That's right.

Mr. OBERSTAR. The gentleman from California, Mr. Packard?

Mr. PACKARD. Thank you, Mr. Chairman.

Ms. Page, first of all, I thought the report was an excellent report, and I appreciated the timing and the quality of the report.

The flexibility that you spoke of in answering to the chairman's question, that that could be an alternative to give some flexibility to extend it an additional year. Would the airlines and would the whole system, the manufacturers and all, prefer to have that flexibility, or would they prefer to have a definite final date as they gear personnel and supply lines and so forth up?

What would be the more advantageous to the manufacturers, to the airlines, and to all of those that are dealing with this whole piece of legislation?

Ms. PAGE. The equipment manufacturers, the TCAS equipment manufacturers, would prefer a 1-year extension because they have invested heavily of their time and effort and finances in gearing up for production, and they need to begin to accumulate some cash flow to cover their costs.

The airlines, however, I am sure—and they will address this themselves later—but would prefer a 2-year extension, for a couple of reasons. The first one is that a 2-year extension would give them an opportunity to phase in the TCAS installation with wind shear equipment and with other parts of the more normal maintenance cycle. And that would be a substantial cost savings for them.

Mr. PACKARD. But the question is would the flexibility be something that they would prefer to have as an alternative to the 1 year? It would appear to me that flexibility may work against them in many ways because they simply cannot make firm plans

in terms of personnel hiring, and they would rather know whether it's one year or two years, not if it's one year maybe we can slide it to two. So, that is my question. Does the flexibility add another dimension that would be virtually unlivable for the different components of this whole process?

Ms. PAGE. That is a good point. It does add an air of uncertainty, and in my testimony I stress that it was important to provide definite parameters.

Making that decision involves weighing the issue Mr. Oberstar raised about the increased risk of the possible midair collision in that year against all the other factors that would speak to the wisdom of making a definite commitment to a 2-year extension and then making sure that everyone lives up to that.

Mr. PACKARD. One more question, Mr. Chairman, maybe two.

Your report addresses the numbers of technicians and facilities that would be made available to implement and install the equipment.

From what source does that data come, and would you express your feelings concerning that issue as it helps us to determine whether a 1- or a 2-year extension is the more appropriate?

Ms. PAGE. I can't speak to hard numbers with any degree of confidence because every facility that we have spoke with and every provider of services assured us that they were fully capable of gearing up and meeting the needs.

A major crunch is the fact that there are really not—we did not have a lot of confidence that there is available skilled electronics, radio and electronics engineering capability. It takes a good length of time to train those folks, and they are already in short supply.

I would think that a 2-year extension would permit some comfort and additional opportunity to utilize the resources available.

Mr. PACKARD. One last question, and it may be an area where you didn't review at all.

Is there projected to be any substantial savings in terms of insurance in terms of premium costs to the airlines as this equipment is installed, and are there some offsetting benefits that would come from that source in terms of the rather sizable cost of installing this equipment on each aircraft?

Ms. PAGE. I don't know whether insurance companies have been forthcoming about promising lower insurance rates.

Mr. PACKARD. Premium reductions. Right.

Ms. PAGE. Often, airlines self-insure up to a certain point and then there is a pool.

I would say that the problem is really not that the airlines don't want this, it's a question of how to do it.

Mr. PACKARD. Oh, I agree.

Again, I appreciate and applaud your report.

Thank you, Mr. Chairman.

Mr. OBERSTAR. Thank you.

Now it gives me great pleasure to call on the gentleman who wore this hat for 8 years and presided over the legislation, now law, the gentleman from California, Mr. Mineta.

Mr. MINETA. Thank you very much, Mr. Chairman.

I just want to thank Ms. Page and OTA for their work on this report.

I take it when you talk about a phased installation schedule in 1991, is there any specific schedule you prescribe for that?

Ms. PAGE. No. We felt it was premature to do that, since there were still a number of uncertainties related to the certification of the equipment for each airline. And at the time we were completing the report, there was one manufacturer that still had not really perfected their production equipment.

Mr. MINETA. So that the portion dealing with talking about the fourth option emerging, that was sort of an after—not an afterthought, but it was——

Ms. PAGE. Oh, no, it certainly was not an afterthought.

But that option came out of our workshop, and it seemed that it was in the context, sort of, of a neutral setting at OTA with all the parties sitting around the table that they began to discuss, well, how could we go about getting an operational evaluation and getting the kind of information that we know we are going to need about how this system will work with air traffic and in the airspaces that are particularly crowded, as the ones in California are, that that fourth option emerged.

And it was not an afterthought. Perhaps I misunderstood your earlier questions. Have I addressed it adequately now?

Mr. MINETA. The thing is, I am wondering if we extend the present December 31, 1991, date, have you thought out how whether or not, if you extend it, as to whether or not it's one-third, one-third, one-third out to the extended date, or do we just go ahead and extend the December 31, 1991, date without a specific scheduling of that phase-in?

Ms. PAGE. I see. I did misunderstand your question.

It's difficult to establish exact deadlines for each phase that will apply equitably to each airline. The airlines will schedule with a 2-year extension probably a quarter of the installation racking and wiring for each year because that is what they would normally do during their down time anyway. And the part of the implementation that is referred to in phasing really is the installation of the box itself.

So, you could install in 15 to 30 percent of the fleet by probably December '91 and then require that an additional third—Kevin is correcting me. December 1990, excuse me. And require that an additional third be installed by the end of '91 and the rest later.

I felt—our feeling was that this is something that needed to be worked out by the operational evaluation committee and that the important thing for Congress to use was their capability to assure that early in the program up to 30 percent were installed. Otherwise, the feeling was that there might be delays in actually putting in the boxes.

Mr. MINETA. Was this driven by the other equipment; namely, the wind shear alert?

Ms. PAGE. Kevin, do you want to answer that?

Mr. DOPART. No, that was a consideration, but the three points we made were the phased implementation schedule, the deadline, and the operational evaluation—all were interrelated. If you just extended the deadline, an interesting point we heard from most of the airlines is that they wouldn't install the boxes——

Mr. MINETA. Until the very end?

Mr. DOPART [continuing]. Until the very end.

Mr. MINETA. That is what I want to try to avoid.

Mr. DOPART. That's why we said we need a phased implementation program just for that alone. The implementation program also reduces the economic penalty on the manufacturers. By extending the deadline, their cash flow would go down unless there were some early sales. So, it was a trade-off on that side. And to do the operational evaluation program, you needed the phased implementation too.

So, everything that we presented covers not only safety but economics and the international considerations. Wind shear was just an additional burden on their other schedule.

Mr. MINETA. Now, what about foreign carriers, will they be able to comply with the 1991 deadline or the 1992, 1993, whenever the deadline might be?

Ms. PAGE. The chances are better that the international agreement on the international requirements for TCAS will be in place and that they would comply with the 1993 deadline.

They definitely would have grave difficulties with the 1991 cutoff point.

Mr. DOPART. The international standards will not be set until the summer of 1990, I believe, for TCAS.

Mr. MINETA. Until the summer of 1990?

Mr. DOPART. I believe so.

Ms. PAGE. Those are just the standards. That doesn't bring you close enough to being able to install the equipment.

Mr. MINETA. Well, I guess the point, Mr. Chairman, that bothers me—and I really appreciate your setting these hearings and the leadership that you bring to this—it seems to me that we are going to be hearing a lot of things that it seems to me we should have heard maybe when we set this deadline some time ago. And I don't know, somebody would have to remind me or correct me about whether or not we heard some of these cautions at the time we implemented the kind of suggested legislation that Mr. Packard brought to us.

You know, I just felt that we did that at the time, knowing full well the technology, knowing the problems, but we wanted to get on schedule to get ahead with what we were doing.

So, I would hope that we would be able, however we approach this, to do it equitably but do it as quickly as possible.

Again, I want to thank you very much.

Mr. OBERSTAR. Well, the concern that I have is that the law now sets a standard of safety, a yardstick by which to measure safety in this particular domain, and that any change in that law is going to be perceived—at the very least—perceived as a step back from safety. And what I want to be sure of in the course of this hearing is that whatever is done, if anything is done, to modify that timeframe, is not in derogation of safety.

Mr. MINETA. I would be pleased to yield to my colleague.

Mr. PACKARD. Would the gentleman yield?

Certainly not in defense of the extension, but when the law or the bill was introduced and when it was ultimately passed, OTA had not done their study and had not been able to make their recommendations.

It is obvious that we did not know all the facts, and perhaps that is the reason for the desire for an extension.

Mr. MINETA. It seems to me, if I might reclaim my time, at that point that we had the support of all of the actors at that time.

Well, again, thank you very much, Mr. Chairman.

Mr. OBERSTAR. The gentleman from Pennsylvania?

Mr. CLINGER. Thank you very much, Mr. Chairman.

Just a couple of questions with regard to the operational evaluation testing.

The airlines tell me that it is going to take about is six months to really develop a plan to come up with the procedures and how they are going to proceed with the testing, and then, as I understood it, another six months to test.

Does that seem like a reasonable time frame to complete the operational testing, about a year's time?

Ms. PAGE. Yes. This is assuming that they begin with the plan pronto.

Mr. CLINGER. Promptly.

Ms. PAGE. Or in a timely way. And there is no reason why they can't do that. The flight testing will be concluded within a month or so.

Mr. CLINGER. Right.

Ms. PAGE. And our hope is that the group that is developing this operational evaluation program, which I believe has already had a few meetings, would move in a very rapid manner to finalize their plans.

Mr. CLINGER. Don't we really need to know what that plan is going to look like before we can make a determination of how many aircraft have to be retrofitted in order to carry out an appropriate operational evaluation program? In other words, whether we are going to need 15 percent of the fleet retrofitted or 30 percent really depends on what the composition or the shape of the plan is going to be, wouldn't it?

Ms. PAGE. We asked that question at our workshop, and the response from both manufacturers and airlines was that carefully structuring the types of aircraft that were used—that is, the short-haul ones—and choosing the types of airports into which they flew could be done relatively without too much delay and that as with any kind of evaluation you can never be certain as to when you will know most of the problems.

But the consensus was very clear that if you tested between 20 and 25, somewhere in there, you would get most of the problems if you structured the type of aircraft and the airports carefully.

Mr. CLINGER. Yes.

Ms. PAGE. And there wasn't a lot of disagreement on that among the parties at the workshop.

Mr. CLINGER. So that if we had what the airlines are proposing, 15 percent or 600 aircraft, would you think that you could effect the kind of operational testing, comprehensive operational testing that would be required?

Ms. PAGE. That would be the minimum.

Mr. CLINGER. OK.

Ms. PAGE. That would be the minimum.

Mr. CLINGER. And the more the better, basically?

Ms. PAGE. Exactly. As I think I understand it, the number of aircraft, the absolute number, is somewhat less important than that the issues of the type of airspace and aircraft be addressed and evaluated.

Mr. CLINGER. And clearly, we are going to try to do this in a way that would give us different sizes of airports, different sizes of traffic patterns and that sort of thing.

Ms. PAGE. That's right.

Mr. CLINGER. One of the limitations that has been suggested that is going to make it difficult to comply with Congressman Packard's bill is the assertion that there are limited facilities to accomplish this retrofitting and that in fact a lot of it has to be contracted out and that there just is a finite number of people or firms able to do this.

Have you looked at this question at all?

Ms. PAGE. We did look at it. And the airlines that have begun to request proposals from facilities because they feel they will need to contract out some maintenance have had good response, but have not felt—that is, in terms of numbers—but they have not felt that the capabilities of some of the different suppliers of maintenance capability met their standards for one reason or another.

Now, each airline is going to have a slightly different type of need depending on what their inhouse capabilities are and what type of engineering expertise they have on their staffs already.

We expect that there will be difficulty, but as I said earlier, it is impossible to evaluate the exact magnitude of that difficulty because when we made our sweep of the maintenance facilities—that is, those who provide contract maintenance as their major activity—they assured us that they would be able to gear up to do this.

So, that is a different kind of response than you hear from the airlines. It really does depend on whom you ask.

Mr. CLINGER. Sure.

I think what you are suggesting here is there are a number of things that could result in a need to delay, but by providing for the possibility of an extension of six months or a year, we could accommodate those kinds of concerns if they arise during the process of an operational evaluation.

Ms. PAGE. That's right.

If I might take just a moment to return to Mr. Mineta's questions about whether you hadn't heard all this before at the time you passed the original legislation. I would just point out that we didn't have results from the limited installation programs at the time that legislation was passed. And those have had a significant impact both in encouraging us to go ahead with TCAS because of the enthusiasm of the pilots and the feeling that they welcome this technology and that it does make them feel much more secure in being able to identify possible intruders in their airspace.

But there have been some difficulties with it: nuisance alarms and recommended changes on the part of those participating in the LIP program in the software. And it's very important to continue that process, as you pointed out, Mr. Clinger, for acceptance, good acceptance by the pilots so that they are able to take full advantage of the safety benefits.

Mr. CLINGER. And can rely on them with some degree of confidence.

Ms. PAGE. Yes. That does not seem to be a problem on the basis of the LIP. But nonetheless, we haven't seen it operating except on a very limited basis.

Mr. CLINGER. Well, in this regard, you mentioned that if there were necessary changes, they would be in the software. Is that your sense? It would not be in the hardware?

Ms. PAGE. That is absolutely right. And while you were out voting, the FAA provided me with the brochures from the manufacturers that I understand all the committee members have. These show production line hardware. The hardware is available. It is the software changes—and they are critical changes; that is, if the software isn't absolutely correct, then you will need to reevaluate.

Mr. CLINGER. Sure.

Ms. PAGE. But it is those that will need to be done at the last minute.

Mr. CLINGER. And if there are changes that become necessary as a result of the operational evaluation testing, what kind of disruption would you anticipate this might cause the airlines? I mean is it going to be kind of a major disruption where they're going to have to take planes out of service for an extended period in order to make those changes?

Ms. PAGE. At this time there is no indication that that would have to be done.

Mr. CLINGER. They're not going to have to rip everything out and start over again?

Ms. PAGE. No, they certainly would not have to do that in any case. The purpose of the evaluation program is to catch anything that would—we don't anticipate that there would be anything that would approach that magnitude, but there may be small changes that need to be made.

If you catch those small changes when you still have a limited proportion of the fleet with that kind of software, there is a much better chance that the software will be changed over later on.

Now, if you moved ahead on an absolutely lock-step schedule——

Mr. CLINGER. Right.

Ms. PAGE [continuing]. And there was a need for changes, pilots have expressed concern to us that those who were flying aircraft equipped early in the program would have to wait a very long time before that equipment was changed over because they would be moving ahead with the other, the newer software.

Mr. CLINGER. Thank you very much. I certainly thank you for a very excellent study and for your very fine testimony.

Ms. PAGE. Thank you.

Mr. OBERSTAR. A couple of further questions.

You raise a very important point on page six about competition among the manufacturers in pointing out that the manufacturers:

> Who were not early supporters of TCAS II development may reap benefits from such postponements, while those who invested heavily in development and testing programs will face cash flow problems as they gear up for production.

There clearly are some down sides and some up sides and some inequities, perhaps, in the extension of time.

Do you have anything further to amplify on that aspect, not necessarily here with this testimony but some documentation that could be collected in the course of your inquiry into this issue that we could look at further?

Ms. PAGE. We could discuss that point with you, certainly.

We did understand, as we proceeded with the study, that some manufacturers had been working on this very hard for a very long time and had their equipment out for testing at an earlier date. And in fact, one of the manufacturers who was telling us verbally that they were prepared to meet a 1990 or 1989 production date, did not make it to our workshop even though they were invited. And one of the reasons was that they were having more difficulty because of the late start.

Mr. OBERSTAR. And they have a lot of sunk costs of their own plus the development and testing money.

Ms. PAGE. That's correct.

Mr. OBERSTAR. And delay benefits those who weren't in it early. They get a chance to catch up with those who were early in the program.

Ms. PAGE. That is one of the inequities we were discussing when we said there were economic inequities.

Mr. OBERSTAR. I think we need to take a further look at that aspect of it, just to see. I think we need to know what are all the consequences of any such action to extend time frames.

Mr. PACKARD. Would the Chairman please yield on that issue?

Mr. OBERSTAR. Yes.

Mr. PACKARD. I think again we need to make clear—and some of Mr. Mineta's questions may have needed the same response—we are not proposing to delay the beginning, only the end date. The beginning of implementing remains the same as existing law. We do structure it with a schedule, an implementation schedule of 25 percent, 50 percent, et cetera, and a finish date. But we do not change the beginning.

Mr. OBERSTAR. I understand that, but I anticipate in the nature of things, having been in this business for 25 years, a knock on my door and your door and the subcommittee door by the manufacturers who are saying, "Wait a minute now, what you're going to do here is terribly unfair to those of us who were in early," and others are going to come in and say, "Oh, give us a little time. You aren't allowing for free competition in the marketplace."

I just want to have an understanding of the dimension of all these issues before we move anywhere. That is why I raised the question. Better to know first than after.

Mr. PACKARD. If the gentleman would continue to yield.

I understand that concern, but certainly where they are signing long-term contracts with the airlines—and many of them are doing so, as Ms. Page already indicated—those that are ready to move at the early part of the requirement, in other words, start providing them to the airlines at the beginning of implementation or of installation, certainly will have a better position to sign full-term contracts if they can provide them at the onset.

Mr. OBERSTAR. Sure.

You raised some international questions, and one that intrigues me is your focus on claims, at the bottom of page six, that the United States may have abrogated Article 37 of the Convention on International Civil Aviation.

In what specific ways do these critics say we have violated ICAO?

Ms. PAGE. It related to the fact that actions that affect international transport should be developed in concert among the affected parties and this was——

Mr. OBERSTAR. As a result of a multilateral agreement rather than an arbitrary imposition or unilateral imposition by Federal law?

Ms. PAGE. I believe that's correct. That's right.

You may wish to follow this up with the FAA. But our understanding was that that was the issue, that this was an action taken unilaterally and out of concert with the international schedule.

Mr. OBERSTAR. You also suggest that if the current schedule is adhered to, that airlines will petition for exception from maintenance requirements on items other than TCAS.

Have you received some indication of other items that they may want to have deferred?

Ms. PAGE. When we wrote that, we had in mind some of the difficulties associated with the additional inspections for aging aircraft that were beginning to be required just at that time because of the Aloha Airlines accident. And we were making that point because of the difficulties in maintenance facilities and just sheer dockside equipment and space.

Mr. OBERSTAR. I see.

There is a difference, of course, in impact between the 15 percent lower estimate than the upper estimate of 30 percent of the TCAS installation for first-year operational evaluation.

Do you come down in between? Do you stick with one or the other of those numbers? What is your considered judgment on how much of the fleet should be outfitted with TCAS in that time frame?

Ms. PAGE. As Mr. Clinger said, the more the better, sir. I would like to see 25 to 30 percent. I think that is an issue that can probably be resolved by the evaluation committee. I don't think that the issue is so much exactly the absolute numbers that you resolve these questions.

Mr. OBERSTAR. OK.

You suggest also that FAA may need some contract support beginning later this year to undertake this procurement. What would be the nature of that support, and can it be accommodated within FAA's existing budget?

Mr. DOPART. I am not sure if it can be accommodated within the existing budget. But the way it has been operated during the limited installation program is data were collected from the airlines that had TCAS installed and a contractor analyzed that data for the FAA.

We were under the assumption that a similar thing would be required for the operational evaluation program, especially since we envision many more aircraft would be outfitted, on the order of maybe 50 to 60 airplanes, with data recorders.

So, it would be a similar program to what is now ongoing with Northwest and formerly with United.

Mr. OBERSTAR. There may be other questions that will come to mind after we have proceeded with other witnesses and as we proceed further with refinement of the legislation, and we will be back in touch with you on an informal basis.

We thank you very much for your presentation and the splendid work that you have done.

Ms. PAGE. We are happy to. Thank you.

Mr. OBERSTAR. Yes, counsel reminds me, we will see you next week on another matter.

Ms. PAGE. That's right.

[The prepared statement of Ms. Page follows:]

AIRCRAFT COLLISION AVOIDANCE TECHNOLOGY

STATEMENT OF EDITH B. PAGE
Project Director

Accompanied by
Kevin Dopart
Principal Analyst

Office of Technology Assessment
Congress of the United States

Testimony Before
Subcommittee on Aviation
Committee on Public Works and Transportation
U.S. House of Representatives

May 4, 1989

Statement of Edith B. Page
May 4, 1989

Good afternoon. In September 1988, the Office of Technology Assessment was asked by the Subcommittee on Aviation of the Senate Committee on Commerce, Science, and Transportation to consider the implications of the implementation schedule for the Traffic Alert and Collision Avoidance System (TCAS II). In November, Mr. Oberstar, as Chairman of a Subcommittee of the House Committee on Public Works and Transportation, formally endorsed the study. It is a pleasure to appear before this Subcommittee to share the results of OTA's special report, Safer Skies with TCAS, which identifies several approaches to increasing collision avoidance protection for the flying public.

The compliance deadline established in Public Law 100-223 for implementing TCAS II has safety, economic, and international consequences not fully foreseen at the time of enactment. The TCAS II program is a complex and delicate combination of advanced technologies, requirements for rapid introduction, and impact on a large number of commercial aircraft. **OTA found that aviation safety will be best served by introducing TCAS II on commercial aircraft as soon as possible, by requiring a phased implementation schedule, and by providing for a structured evaluation program carried out jointly by industry and the Federal Aviation Administration (FAA) to oversee the first phase of operation.**

WHAT SHOULD BE DONE

Three possible congressional approaches (no legislative action, an evaluation program within the existing time constraints, and a deadline extension with an unspecified operational evaluation) were being discussed when OTA began this study.

While each option could provide some benefits, each would also leave significant problems. As OTA's study neared completion, a fourth option emerged that represented a consensus of the groups working with OTA: amending Public Law 100-223 to require a phased implementation schedule beginning in 1990 (to ensure early equipage of a substantial portion of the fleet), a structured operational evaluation program, and extension of the deadline. (The possible timing options for TCAS II installation may be seen in Figure 1.) The bill proposed by Congressman Packard addresses each of the issues raised under this approach.

OTA found no reason to delay initial TCAS II implementation, but concluded that airline resource limitations, economic inequities, and international implications that stem from the present deadline give Congress reason to consider extending the installation schedule. However, prompt congressional consideration of any changes is important. All parties need a quick decision if they are to respond responsively.

If such an extension is enacted, specific requirements in the same law are needed so that installation of TCAS II begins promptly after production equipment is available and proceeds at a reasonable pace until enough aircraft – perhaps 15-30 percent of the fleet – are equipped for the operational evaluation. The forcing effect of legislation is necessary to provide safety benefits as early as possible and to encourage airlines to make appropriate plans for personnel and equipment.

Although requiring and linking an operational evaluation program, a phased compliance schedule, and an extended deadline place additional responsibilities on each affected party, this approach appears to spread economic burdens more equitably than other possible options. It avoids the high cost if operational glitches occur, and it gets some TCAS II in sooner.

To ensure full benefits of an evaluation program, a critical number of aircraft must be outfitted with TCAS II – the 15 to 30 percent (600 to 1,200 aircraft) of the commercial fleet mentioned above. (Participants at OTA's workshop indicated that probably no more than 30 percent of the passenger transports could be equipped with TCAS II in time for an early operational evaluation beginning in December 1990. They further indicated that TCAS operating on about 15 percent of the commercial fleet was the minimum number necessary to cover the full spectrum of possible system effects.)

Industry and FAA will need to cooperate in this evaluation, covering the range of aircraft and airspace types and allocating sufficient resources for collecting, analyzing, and disseminating data. **Congress may wish to see that FAA and industry have a suitable plan for conducting the operational evaluation and acting on its findings.** Requiring periodic progress reports by FAA to Congress is the way to do this. In addition to sufficient staff and funds, FAA may need contract support beginning late this year when aircraft equipped with the latest version of TCAS II enter service, and provision for this could be made in the agency budget.

Each of the limited operational evaluations to date have suggested procedural and equipment changes for TCAS II, and the FAA and industry have disagreed on which changes are critical to safety and should be required. A large scale evaluation program may have similar results. It is incumbent on the FAA-industry group developing the evaluation to provide a framework for resolving differences. Any changes necessary for TCAS or operating procedures will affect the capability to meet implementation milestones. Congress may wish to give FAA authority for some flexibility in the deadline criteria.

OTA'S STUDY PROCESS

All segments of the aviation community cooperated fully during the course of our research, providing information to OTA and working to develop a common solution for a number of difficult issues. Throughout the study, FAA, the airlines, equipment manufacturers, pilots, maintenance specialists, and airframe manufacturers played key roles in assisting OTA through interviews, site visits, written comments, and responses to questionnaires. (See Attachment A for a list of reviewers and contributors.) In January, as the study neared completion, OTA held a workshop with representatives from all these groups to review our findings and to guide us in shaping the policy options that appear in this testimony. (A roster of workshop participants may be found in Attachment B). All told, this study represented an admirable cooperative effort, and I would like to express publicly the gratitude of our agency for the help we were given.

TCAS II SAFETY CONCERNS

The safety concerns related to the present TCAS II-schedule are twofold: 1) the as-yet-unknown effect of full TCAS II implementation; and 2) the possibility of reduced safety in other areas of this air transport system because resources are strained or diverted from maintenance needs in order to fully implement TCAS II by December 30, 1991. The limited installation programs undertaken to date have involved only two commercial aircraft and did not provide an adequate asssessment of the effects of a fully-equipped fleet on the air traffic system. The reactions and interactions of pilots, controllers, and TCAS II within the air traffic system cannot be determined until large numbers of aircraft equipped with TCAS are in operation. Though TCAS II technology itself is now well developed, a more widespread operational evaluation is justified to

determine whether software or hardware modification are called for when it is used throughout the system, or whether pilot or air traffic control procedures must be changed.

The second safety concern stems from the limited amount of time – about 2 years -- that the airlines will have to meet the congressional deadline once the equipment is ready to install. Manufacturers must produce and deliver equipment, airlines and others must redesign and modify aircraft, and FAA must certify equipment and altered aircraft. This will strain the resources of virtually every participating aviation organization. While many domestic and foreign airlines can probably meet the deadline, other critical maintenance and modification programs are likely to suffer. Airlines will have to remove about one-half of their fleets from scheduled service for at least a few days to install TCAS II. Faced with limited numbers of skilled technicians and engineering and maintenance resources, airlines plan to contract out TCAS II work, use overtime, cut discretionary maintenance, and petition for exemptions from other maintenance requirements. These strains on resources could degrade the quality of both TCAS II installations and other important maintenance and safety activities, such as those associated with aging aircraft. Development is still incomplete for some TCAS II display options, ground test equipment, and technology suitable for commuter aircraft, compounding the uncertainties surrounding installation time.

ECONOMIC ISSUES

The economic consequences of the implementation deadline will affect each airline differently. Airlines that are financially healthy will be much better able to meet the demands of a tight deadline than airlines with cash flow or labor problems. Out-of-service time for aircraft raises equity issues separate from the direct costs of installing

TCAS II. Airlines without extra aircraft are likely to lose passengers to other airlines for a short time, whereas companies with more resources can avoid canceling service. Airlines that fail to meet the deadline will be penalized severely if unequipped aircraft are not permitted to fly in U.S. airspace in 1992. However, airlines that complete TCAS II installations on time will face indirect cost penalties if their competitors do not commit similar resources and are granted extensions.

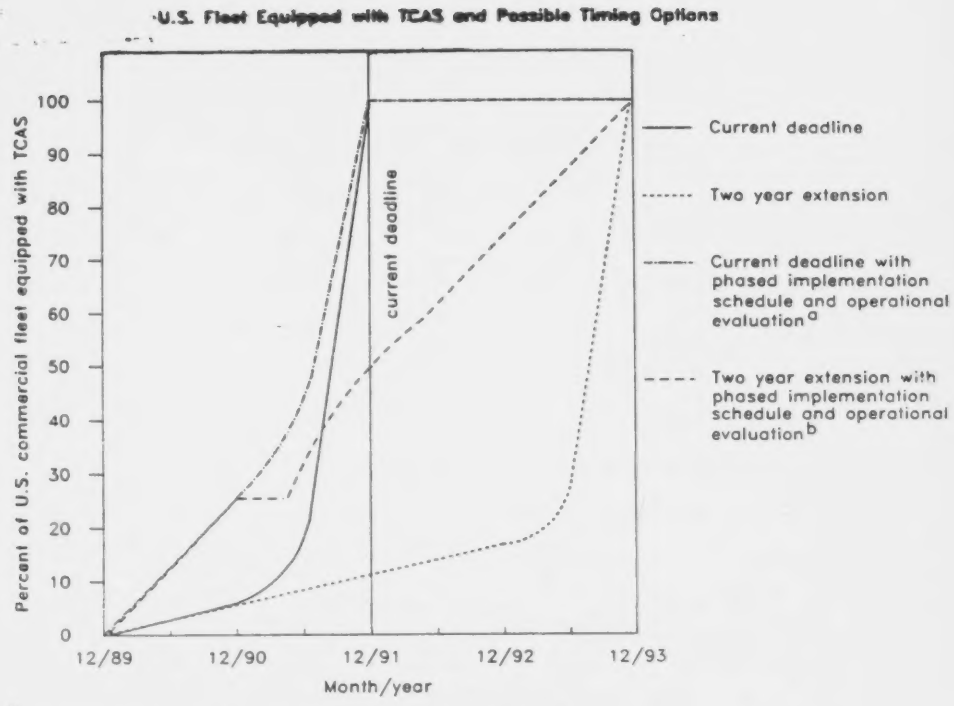
The TCAS II installation requirement has a different effect on the various U.S. TCAS manufacturers. Expecting over 6,000 orders from domestic and foreign airline by the end of 1991, these companies have invested accordingly. Under the current schedule, airlines may postpone taking delivery of equipment until late in 1991 to allow modification to be made before their purchases are effective. Equipment manufacturers who were not early supporters of TCAS II development may reap benefits from such postponements, while those that invested heavily in development and testing programs will face cash flow problems as they gear up for production.

INTERNATIONAL ISSUES

Foreign airlines contend that the installation of collision avoidance systems in international air transports should occur on the basis of agreed international standards and recommended practices. Such standards are under consideration in the International Civil Aviation Organization (ICAO) and are currently scheduled for adoption in 1990. Many question the appropriateness of the United States action in including foreign carriers within the scope of its TCAS II requirements, claiming this undermines the basic objectives of ICAO in producing international standards. Moreover, critics claim the United States may have abrogated Article 37 of the Convention on International Civil Aviation by its actions.

Legislation addressing the issues raised in this testimony can further an important aviation safety program on a realistic and achievable schedule. OTA is pleased to have participated in identifying issues for the Congress. Thank you for the opportunity to testify, and we will be happy to answer questions.

FIGURE 1



[a] Time constraints with a 12/91 implementation deadline do not permit an installation level off during the operational evaluation and analysis.

[b] This curve suggests only one of several possibilities.

SOURCE: Office of Technology Assessment.

Attachment A

REVIEWERS AND CONTRIBUTORS

Aer Lingus
Aeronautical Radio, Inc.
Air Canada
Air France
Air Wisconsin
Air-India
Alaska Airlines
Alitalia
Allied-Signal Aerospace Co.
America West Airlines
American Airlines
Associated Air Center
Wayne J. Barlow, Federal Aviation Administration
Boeing Commercial Airplane Co.
Braniff
British Airways
Anthony J. Broderick, Federal Aviation Administration
Command Airways
Continental Airlines
Dalfort Aviation Services
Joseph M. Del Balzo, Federal Aviation Administration
Delta Air Lines
Douglas Aircraft Co.
Eastern Air Lines
El Al Israel Airlines
Evergreen Air Center
Finnair
Roger Fleming, Air Transport Association
L.R. Ganse, Trans World Airlines
Michel Guyard, French Embassy
Joseph Hawkins, Federal Aviation Administration
Heli-Dyne Systems
Honeywell
Horizon Air
D. P. Huffman, American Airlines
Iberia
Larry James, Trans World Airlines
Japan Air Lines
KLM Royal Dutch Airlines
Keith H. King, International Air Transport Association
Clyde Kizer, Air Transport Association
Hart A. Langer, Pan American World Airways
Lufthansa German Airlines
David McMillan, British Embassy
C.R. Melugin, Jr., Federal Aviation Administration
Northwest Airlines
Pan Am Express
Pan American World Airways
Michael Parkes, British Embassy
Philippine Airlines
B. Keith Potts, Federal Aviation Administration
Qantas Airways
Jack Raia, Pan American World Airways
Francis C. Rock, Federal Aviation Administration
Rockwell International
Sabena Belgian World Airlines
Daniel P. Salvano, Federal Aviation Administration
Saudi Arabian Airlines
Scandinavian Airlines System
Southwest Airlines
William J. Sullivan, Federal Aviation Administration
Swissair
Tracor Aviation
Tramco
Trans World Airlines
USAir
United Airlines

Attachment B

Participants in Workshop on Getting Collision Avoidance Airborne: TCAS Installation and Federal Deadlines, January 12, 1989

Richard E. Rowberg, *Workshop Chair*
Science Policy Research Division
Congressional Research Service

Robert Buley
Flight Standards
Northwest Airlines

Sherry Chappell
NASA Ames Research Center

Jim Deckert
Marketing Manager
Sperry Commercial Flight Systems Group
Honeywell, Inc.

Joe Fee
ACADS Program Manager
Federal Aviation Administration

John Fredericksen
Executive Vice President
Regional Airline Association

John Graham
Senior Staff Engineer
Flight Guidance and Control Engineering
Douglas Aircraft Co.

Ulf Gustafsson
Staff Engineer
Engineering Program
United Airlines

Jack D. Howell
Chairman, Air Traffic
Control Committee
Air Line Pilots Association

Thomas McSweeny
Deputy Director
Aircraft Certification Service
Federal Aviation Administration

John O'Brien
Director, Engineering and
Air Safety Department
Air Line Pilots Association

Carl Olberg
Director for Engineering
America West Airlines

Richard A. Peal
Director
Avionics/Flight Systems
Boeing Commercial Airplane Co.

Ron Smith
Vice President, Operations
Tracor Aviation, Inc.

Ray Valeika
Senior Vice President
Technical Operations
Continental Airlines

Frank White
Honeywell

Joe Wilson
TCAS Program
Air Transport Avionics Division
Bendix/King

Mr. OBERSTAR. Our next witness, Mr. Clyde Kizer, vice president, engineering and maintenance of the Air Transport Association. And he is going to be accompanied by associates, whom I would invite you to introduce at this point.

TESTIMONY OF CLYDE R. KIZER, VICE PRESIDENT, ENGINEERING AND MAINTENANCE, AIR TRANSPORT ASSOCIATION, ACCOMPANIED BY CAPT. ROBERT BULY, NORTHWEST AIRLINES; AND ULF GUSTAFSSON, UNITED AIRLINES

Mr. KIZER. Yes, Mr. Chairman. I have Captain Buly from Northwest Airlines and Ulf Gustafsson from United Airlines, both who are intimately involved in the TCAS development.

Mr. OBERSTAR. Ulf Gustafsson.

Mr. GUSTAFSSON. That's right.

Mr. OBERSTAR. We are delighted to have you here on this very serious, very complex subject, and welcome your testimony.

Mr. KIZER. Mr. Chairman, I would ask that my full testimony be included in the record and that I be allowed to summarize it.

Mr. OBERSTAR. Without objection, so ordered.

Mr. KIZER. Mr. Chairman, my name is Clyde Richard Kizer. I am vice president, engineering and maintenance, for the Air Transport Association. I am accompanied today by Capt. Robert Buly of Northwest Airlines and Mr. Ulf Gustafsson, United Airlines. Both gentlemen are directly involved with the cooperative Government-industry TCAS program known as LIP, the limited installation program.

My remarks today will review the progress and concerns of the Air Transport Industry regarding the implementation of the traffic alert and collision avoidance system, TCAS II, in keeping with the requirements of Public Law 100-223, and relate those concerns to the conclusions and options contained in the special study conducted for Congress by the Office of Technology Assessment.

Representatives of the Air Transport Association appeared before you on September 25, 1986. At that time, you served as chairman of the Investigations and Oversight Committee. The primary focus of that testimony was on the progress that had been made in bringing TCAS II to an advanced state of development.

You are well aware of the interest of the ATA member airlines in the development of an effective aircraft collision avoidance system. The ATA initiated the original requirement for such a system in 1955. We must complete all the steps necessary to ensure that the TCAS system we install in our airplanes functions properly; we must not inadvertently introduce some fault that might compromise rather than enhance safety; we must ensure that our pilots and our air traffic controllers have confidence in the system and can use it in the intended manner.

A fundamental principle needs to be restated to ensure understanding of the role of TCAS II: The system is a backup to the services provided by ATC. Therefore, we must ensure that TCAS II is fully compatible with the ATC system and the rules and operating procedures which apply within that system.

United Airlines LIP flights were conducted in July 1988, and United's evaluation report was issued in October of 1988. Northwest

formally completed their LIP flight program in March of 1989, and their evaluation report will be issued in June of 1989.

Both United's and Northwest's LIP installation programs identified a number of changes needed in the TCAS II system.

Change 6 to the minimum operational performance standards, or MOPS, for TCAS, which includes important changes to over 30 percent of the collision avoidance logic, is still being validated. Tests to validate that logic have slipped. This may result in delays in certification and initial equipment deliveries.

Change 7 is under development and will incorporate additional modifications based on United and Northwest LIP experience and to facilitate international acceptance.

A substantive finding of the United LIP evaluation concerns the number of traffic advisories, TA's, and resolution advisories, RA's, encountered during the six-month evaluation. LIP findings extrapolated to full airline fleet operation of 18,000 flights daily indicate that traffic advisories could occur at the rate of approximately 18,000 per day and resolution advisories could occur at the rate of 1,000 to 2,000 per day.

This rate could have significant implications for flight crews and air traffic controllers, especially in high-density areas where 80 percent of the advisories were encountered.

Captain Buly is prepared to brief you on the highlights of the Northwest program and the operational concerns of flight crews receiving compressed-time, multiple advisories while conducting noise-abatement takeoffs from John Wayne Orange County Airport.

In the past, premature introduction of avionics equipment, such as the ground proximity warning system, has led to lack of confidence and ultimate rejection of system use. False warnings resulting from inadequate operational evaluation degraded, rather than enhanced safety. TCAS is significantly more complex than GPWS, with far greater safety ramifications.

It is absolutely essential that the operational effects of a significant sample of TCAS-equipped aircraft be evaluated prior to full fleet implementation. The results of the evaluation would determine the need to revise operating procedures and/or suggest modifications of the TCAS system to minimize exposure to possible adverse operational effects.

ATA proposes that a one-year operational evaluation involving a 15 percent fleet sample, with concentration on short-haul aircraft, be conducted to achieve these ends. A fleet sample of that size, 500 to 600 aircraft, will ensure that 25 to 30 percent of terminal airspace operations are conducted with TCAS-equipped aircraft.

The OTA study underscores the importance of conducting a comprehensive in-service evaluation. It would require that the installation of TCAS equipment be initiated as soon as each aircraft model is certified by FAA. This process cannot begin until early next year and will require issuance of approximately 150 supplemental-type certificates, which is expected to take 10 to 12 months.

To be effective, the proposed operational evaluation would necessitate participation by the FAA, the airlines, air crew members, air traffic controllers, aircraft manufacturers, and equipment manufacturers.

ATA has organized a cooperative effort to define an effective operational evaluation program. That activity is underway in cooperation with the FAA and is chaired by Mr. Gustafsson.

During the past year, ATA airlines provided "best-effort" implementation schedules information for approximately 3,800 aircraft requiring modification in response to both OTA and ATA requests for such data. All airlines responding to these inquiries agreed that the current compliance date represents an unrealistic target in terms of 100 percent assured fleet compliance. There are inadequate facility and manpower resources to meet all competing maintenance and modification requirements within that timeframe.

The OTA report concluded that:

> Out-of-service time and economic penalties due to TCAS II would be compounded by the windshear and aging-aircraft requirements.

And:

> That TCAS II installation would be least disruptive for airlines if it could be accomplished during the normal heavy-maintenance cycle that occurs about every 4 years for each aircraft.

It is estimated that at least 650 aircraft that otherwise would not be taken out of service will have to be grounded in order to meet the current compliance date. The loss-of-service impact to the traveling public could be reduced significantly if the compliance date were more closely matched to existing production capacity.

ATA airlines planning shows that a compliance date of December 30, 1993, is the most rational in terms of achieving 100 percent compliance for the industry and minimizing the impact on the traveling public.

The OTA study results also demonstrate that revision of the compliance date is necessary to permit a 12-month operational evaluation to be conducted, followed by a phase-in of TCAS modifications.

The major impediment to earlier compliance relates to limited technical manpower and fixed facility resource. These maintenance resource limitations have forced a majority of airlines to seek outside repair facilities and modification centers to accommodate current maintenance workloads. Many airlines who used to have excess maintenance capacity which they contracted out to other airlines can no longer do so.

Even more acute than fixed facility constraints is the lack of adequate specialized technical manpower required to meet the current TCAS compliance date and other required programs. Recent data collected from 14 ATA airlines indicates that they are short more than 4,000 mechanics to their current needs. These are hiring needs that have been approved and funded, but for which there are inadequate numbers of qualified candidates.

Part of the need for additional resource results from the regulatory requirement for the installation of windshear equipment.

Mr. Chairman, you and various other members wrote to the FAA last year inquiring about this very problem. The administrator, in his response in February 1989, stated:

> [That] it would be more efficient if there were congruence between the installation timetables for TCAS and windshear equipment.

And that:

Were it not for the statutory TCAS installation deadline, we would propose a phase-in by regulation and would also be able to make the windshear and TCAS schedules compatible.

In addition to shortages of mechanics, the airlines and the manufacturers are experiencing shortages in engineering staff. Due to shortages in technical staffing, aircraft manufacturers will not be able to provide TCAS installation data with the specific engineering detail required for system certification by FAA. A revised compliance date would allow the manufacturers to redistribute their engineering workload and priorities.

The OTA concluded that Congress should extend the current deadline because of safety, economic, and international consequences not fully foreseen at the time of enactment.

The ATA airlines are strong advocates for rational implementation of TCAS equipment in the air transport fleet. TCAS will contribute significantly to increased safety in air travel. It is crucial that the implementation of TCAS be accomplished in a manner consistent with the dedicated effort that accompanied the development of the system.

The requirement for an operational evaluation combined with the need for incorporation of system changes, efficient use of aircraft maintenance time, maximum use of available modification facility and technical manpower resource, and the desirability of minimizing the impact to the traveling public all support the need for a revised implementation and installation schedule leading to 100 percent compliance by December 30, 1993.

Moreover, since foreign carriers have indicated that 1993 is the earliest that they could come into compliance, an additional beneficial effect of this proposed revision would result from the opportunity this gives them to equip their aircraft.

Mr. Chairman, we need your assistance to assure that the safety objectives of the TCAS system are fully realized. The Federal Aviation Administration, Congress, and the industry should work together to revise the current statute and make necessary administrative steps to combine the TCAS installation and implementation timetable with other ongoing regulatory requirements related to aircraft maintenance and overhaul. Working together, we can assure safety, cost efficiency, and minimum disruption for air travelers.

Captain Buly, Mr. Gustafsson, and I are now prepared to answer any questions that you might have.

Mr. OBERSTAR. Thank you.

Do you want to have Captains Buly and Gustafsson at this point to comment?

Mr. GUSTAFSSON. We are ready for questions.

Mr. OBERSTAR. All right.

Thank you very much. It is a very comprehensive statement and one that is very useful and very important.

Let me ask, just so we get this on record, the cost per unit of TCAS and then the overall estimated cost for so equipping the entire targeted U.S. fleet.

Mr. KIZER. The estimated cost that we made this past year was about $1.1 billion, or $310,000 per aircraft. About $700 million of

that included the maintenance installation and equipment costs and about $400 million reflects out-of-service cost for the airlines.

Mr. OBERSTAR. You are calculating into the per-unit cost also the lost revenue?

Mr. KIZER. Revenue. Yes, sir.

Mr. OBERSTAR. For the down time.

So, if we calculate that roughly over the 4000 domestic aircraft that are targeted for this installation, it would be roughly $4 billion.

Mr. KIZER. Yes, $400 million.

Mr. OBERSTAR. In the out-of-service time for installation, your testimony says 4.9 days. Is that time that can be scheduled, and conveniently so, with aircraft? Or is it going to take another extraordinary amount of scheduling time to do that? Can it be done to conform with your C checks and D checks, I guess is where you are headed?

Mr. KIZER. That would be the most efficient means to do it, of course. But we obviously can't meet the current compliance date by that means, nor could we meet the proposed 1992 date by that means. We would have to take additional aircraft out of service.

The ideal method would be to combine the TCAS installation with a C or D check, which would add five days to either of those evolutions. A special routing line dedicated solely to TCAS, which many airlines will have to do, will require five to six days out of service, assuming a fully qualified crew with the required skills. We have significant problems in that regard right now, as I stated.

Mr. OBERSTAR. What training is going to be required for a crew to operate the TCAS? You are going to have to put them through simulator training, I am sure, and other training?

Mr. KIZER. I will defer to Captain Buly for that response, if I could.

Mr. OBERSTAR. All right.

Mr. BULY. It's interesting, sir, although the system itself is internally extremely complex—in fact, perhaps one of the most complex systems we have ever introduced into an aircraft—the training problem is fairly simple: somewhere on the order of about four hours' dedicated training per pilot, then with a recurrent requirement to follow that on an annual basis.

Mr. OBERSTAR. That can be done, though, with simulator work. Are there simulators available to do this kind of training?

Mr. BULY. No, we do not have, nor do we intend to, at least in the near term, install the equipment in the flight simulators.[1] The initial training will be accomplished using other means, anything from computer-based instruction to stand-up instructor.

Mr. OBERSTAR. I see. I just made an assumption that it would be done with simulators. They are so effective a training device, I just assumed that that is the way it would be done. But you have other means of doing the training.

Mr. BULY. Yes. Initially, the simulator would provide the means whereby the crew could get hands-on experience with the equipment. But in order to have an adequate understanding of the

[1] NOTE.—Although Northwest Airplanes does not intend to use simulators for crew training with TCAS, other airlines do intend to do so.

equipment and its implications in the system, we have to give them an in-depth background training session. And that would take more time, really, than the hands-on experience requires.

Mr. OBERSTAR. One of the points of concern is what really happens in actual air traffic control circumstances in a TCA, a crowded TCA, when you have a sizable number of aircraft in that TCA with TCAS, with Mode C transponders, air traffic controllers and electronic signals beeping across the horizon.

Just from a pilot's standpoint, tell me what are your concerns and what do you want to see resolved, what questions do you have, what complexities do you want to feel have been addressed in this expanded period of time and concentrated test period?

Mr. BULY. I think in a word that is a very difficult question. First of all, sir, the primary concern, the unknown that faces us is the so-called domino effect of a multiplicity of aircraft equipped with this equipment. Although we have run simulations to test the potential for that kind of thing occurring and they have shown that it will not be a problem, we all want to see it. We are a little bit from Missouri in that respect, "Show me."

So, that is a primary concern. The additional workload is a concern. I have some figures here that might illustrate some of those concerns.

If we take our LIP experience and go into the John Wayne County Airport, which you are aware is not only air carrier high-use but also general aviation high-use, it was from a TCAS point of view the most busy or active airport that TCAS was involved in during the course of our implementation program, and we received in that area an average of 2.2 advisories per arrival and 0.7 advisories per departure in the John Wayne County.

The next busiest airport in our system for TCAS was Minneapolis-St. Paul. There we received .4 advisories per arrival and 0.1 advisories per departure.

So, you can see there is a significant difference. Highly structured airspace that is not pressured by general aviation aircraft seems to be a more benign environment for us. But clearly, some airports, such as Santa Ana, present a challenge that we are not certain we are going to be able to deal with.

Mr. OBERSTAR. Based on your experience, do you feel that there are—with TCAS—do you think there are similarities between the installation, similarities in problems of the installation of ground proximity warning systems and installation and operation of TCAS?

Mr. BULY. The significant difference between the two systems, sir, was that the pilot community, with the introduction of GPWS, questioned the need for such a device. And so I think we tended to be far more critical of its shortcomings.

I think our pilot community today recognizes a need for a collision avoidance device and, consequently, are far more or tend to be far more understanding of obvious shortcomings. Of course, they expect us to fix those shortcomings prior to full implementation. But they do recognize and are much more positive in the way they look at this system.

Mr. OBERSTAR. That is very helpful. And that has been a concern, that pilots had a very low degree of confidence in GPWS, and

we don't want that same circumstance to arise with TCAS. But I wanted to probe, and you have answered my question as to why and how and what the response is likely to be from the pilot community.

Mr. BULY. If I may, sir, one additional comment. I didn't mean to imply that pilots would totally forgive improper design. What I am saying is they will be more accepting and more willing to work with us as we improve the design.

Mr. OBERSTAR. Certainly. I appreciate that.

I will withhold further questions at this time and will recognize the gentleman from Pennsylvania at this time.

Mr. CLINGER. Thank you very much, Mr. Chairman.

Ms. Page testified that the proposal that we have maintains the present deadline but to provide flexibility for unforeseen or unanticipated problems that might arise of a six months to a year extension, which in effect would mean that there could be a 2-year delay or a two-year period there for compliance if in fact some of the concerns that I know you have raised, Mr. Kizer, and others, indeed materialize.

Could you live with that kind of a proposal?

Mr. KIZER. A flexible schedule of that nature would not be desirable for the industry, for many reasons. One is that we must plan, we must be able to schedule ahead and provide the resources for the program, and that requires an end date.

But secondly, it also requires that everyone work to the same schedule. It would not be equitable if some airlines were to provide the resource necessary at great sacrifice and accomplish it within the required 2- or -3-year period of time and then other airlines who may not have been quite so diligent be allowed the opportunity, through a waiver or extension, to extend that period.

Mr. CLINGER. I think it is certainly not my idea that we were talking about a case by case; in other words, that an individual airline would come and request an extension based on situations peculiar to that airline. And you are right. I think it would create an inequity where you would have clear winners and losers.

I think what I understood it to be was that if we had some endemic problem that arose to making it very difficult for all airlines to comply, that the extension would be granted on an industrywide basis because of the fact that either the operational evaluation was demonstrating severe problems that were going to have to be addressed and revising the software and so forth.

So, let me ask you in that context if in fact the delay would be granted based upon a systemwide problem, could you live with that?

Mr. KIZER. Well, I think we really developed the plan for this whole program and the operational evaluation predicated on the fact that any expected problems we find will be corrected within the existing schedule.

But certainly, if there are significant problems everyone in the industry would want the option to extend the implementation period to resolve those problems before we put new equipment in the aircraft.

Mr. CLINGER. Well, I think you know what the committee's objective here is, is to keep your feet to the fire.

Mr. KIZER. Yes, sir.

Mr. CLINGER. And to try to expedite this as fast as possible. As the chairman said, we do not want to be seen to be backing away from safety, On the other hand, if in fact we are going to expedite it to the point where—by expediting—we are going to create safety problems, I think that is a concern we have to have as well.

One of the items that you talked about—the capacity to accomplish the retrofitting of 4000 aircraft within the time period—I think you suggested that we have severe strains there because there isn't the capacity to do this in the allotted time.

Could you elaborate a little? Would this require you, for example, to go offshore, or would you be able to do any of this work in maintenance facilities overseas?

Mr. KIZER. There are a lot of ramifications, Congressman. And before I go into that, I wonder if I could have Mr. Gustafsson comment on your previous question. He may have a pertinent comment to make.

Mr. CLINGER. Good.

Mr. KIZER. Mr. Gustafsson?

Mr. GUSTAFSSON. Yes. I just wanted to expand on this idea of the flexibility, the flexible schedule. You have to realize that this project has two parts to it. One is the equipment that we put in the airplane permanently; that is, wiring, antennas and racks and all these other things. And the other one is the active system, the one that plugs into these provisions, into the airplane.

And if we have a schedule which has a flexible ending, we would have to plan for having the airplanes fully equipped for the deadline that we know of. Whether we activate the systems or not, depending on, should we say, FAA or industry acceptance of the system, that is something that comes separately. And a flexible ending has nothing to do with the major part of the work, which is that installation. We would have to plan for it.

Mr. CLINGER. Okay. Let me pursue that a little bit. If we do have problems, it has been suggested the problems would arise not in the hardware but in the software.

Mr. GUSTAFSSON. It will arise in the equipment itself, the one that plugs in and out and is the easy part of the retrofit.

Mr. CLINGER. So you're saying that it would not be a major problem?

Mr. GUSTAFSSON. No, we would not have to take the airplanes down, I don't expect, to modify the airplanes. We would have to take the equipment out to modify the equipment. And that is a simple thing to do and doesn't require resources of the same magnitude that the aircraft installation itself does. We would have to plan for all the resources, all the space, all the money for the short deadline and then hope for the best.

Mr. KIZER. If I might address your question now concerning capacity constraints.

Mr. CLINGER. Yes.

Mr. KIZER. Most of the facilities that the airlines are operating right now in terms of the heavy maintenance or major maintenance capability were built for the piston era and they were built at or near the major locations for the operations of the airlines.

We have virtually reached a point that, because of the size of the aircraft and the size of the engines for the turbine shops, and because of the aging fleet and the requirements for additional maintenance on those aircraft, and because of the increase in airworthiness directive activity as well as those activities directed to the aging aircraft fleet by the current industry activity, we have reached a point where we are exceeding the limits of our capacity.

I took a survey of 14 of the major carriers before these hearings. We have 23 major carriers that belong to ATA. Two of those are Canadian carriers and four of them are cargo carriers, so they are not involved in this TCAS evolution. So, the 14 airlines represents a significant proportion of the remainder. And of those 14, 70 percent of them are now sending aircraft away from their own maintenance facilities to outside facilities for maintenance work, heavy maintenance checks, C checks and above. And those airlines in the past did almost all of that work in their own facilities.

So, we have reached a point where the airlines no longer have dock space.

We have also, as I indicated in the testimony, reached a point where our existing labor force, particularly the specified technical rates (radio and electronic, or R&E mechanics) who are necessary to this TCAS installation. We have exceeded the capability of the community to provide that labor force.

So, we are in a significant constraint with regard to the total technical resource that we have.

Mr. CLINGER. You mentioned, I think, that the foreign airlines have indicated that they could not comply with this before 1993. Why is that?

Mr. KIZER. It is primarily an issue of the specifications that must be developed before they can make the installation. Those specifications have to be approved through the ICAO process. They won't be in a position to make proposals for bids until that is resolved. And then they have to accomplish the installation schedule. In that task they run into the same problems that the U.S. industry faces.

Mr. CLINGER. OK. Thank you very much, Mr. Kizer.

Mr. LAUGHLIN [presiding]. Does the gentleman from Oklahoma have any questions?

Mr. INHOFE. Yes, I do. I have, Mr. Chairman, some statements and questions, and I think I probably am going to end up directing them at the captain.

Mine come from a different perspective, which will be maybe a little unpopular here, but I plan to do all I can to see that we have a respectable time—and to me, 1993 is the very earliest that could fall within the guidelines that would give us the type of security that we want in terms of really knowing what we have and what we have to work with and how reliable it is.

It happens that in my district, I have one of the larger operations. It is the American maintenance base.

I am a 35-year commercial pilot myself. I have peddled around up there with the best equipment and the worst equipment.

I remember one time I was flying a group of people down and we were in a holding pattern over Blue Ridge, going into Love Field, and one of the passengers, who couldn't stand it any longer, said

how do you know that there isn't a plane coming right toward you right now at a closing rate of 800 miles an hour.

I said, it's very simple, we have a bureaucrat down on the ground with a black box who is keeping us apart.

Well, that wasn't a lot of comfort for them at that time.

Now, as a pilot, knowing full well where the technology is—which there is no reason to go into; we have discussed that thoroughly enough—knowing that even if we were to install all of the units ourselves—and I will use the American maintenance because I am sure that the pilots have most faith in their own depots—even if we were able to do that right now, as a pilot I don't believe that they would think that they would have enough reliability in their own mind in the system to really believe in it thoroughly.

Captain, isn't it true that in many instrumentations that you have used over a period of time you have to determine in your own mind what is reliable, what you really believe in, what you really have faith in, number one?

And number two, if you have been with one airline for a period of time and have faith in what their capabilities are, wouldn't you be a little reluctant, not knowing where something was farmed out, to put the lives of yourselves, your crew, and maybe a couple of hundred passengers, in knowing that that was done right, if it was farmed out some place and you really didn't know where it was farmed out to?

Mr. BULY. In answer to your first question, the level of confidence, sir, I think that is something that is constantly on our mind. And in the aftermath of any incident that might affect a piece of equipment on the airplane, it always casts a pall of doubt for the rest of us on how well that equipment or that system functions.

And certainly that is the case with this system. But I have to—there are two types of evaluations we are talking about here. We are talking about the apparent function in front of the crew, and then we are talking about a much more detailed and far more complex problem within the software that really needs analysis.

And I certainly am supporting, sir, your position that we want to take the time to do it right. I believe that, and that is why I am here. But my earlier comment about pilot confidence really addressed the perceived function for a pilot who is using the system day to day as opposed to the very complex internal function and reliability that we also want to look at.

Now, I want to be able to look at my men and say this thing works and works well and I know there are no flaws in it.

Mr. INHOFE. In other words, is it a safe statement to say that in terms of safety, it would be better not to have a system than to have one that you question its accuracy and reliability?

Mr. BULY. You put it much better than I could, sir.

Mr. INHOFE. Well, I doubt that.

But I would have to say, Mr. Chairman, I have some very strong feelings about this, drawing from my own experience as well as many I have seen in the industry and people I have talked to. And I think TCAS is a good thing. It's something we are all concerned with. The public deserves it, and I wish technology were a little further along than it is today.

We want to do all we can from a legislative perspective to hurry it along, but in the meantime, let's be sure we have something we can rely on.

Mr. LAUGHLIN. Thank you very much for your observations.

If there are no other questions, this panel will be excused—yes, sir?

Mr. KIZER. I just have a couple, if I could make a couple more statements to add to the record.

Mr. LAUGHLIN. We need to run and vote here.

Mr. KIZER. OK.

Mr. LAUGHLIN. We are going to recess now for 15 minutes, and we will take it up when we get back.

Mr. KIZER. All right, sir.

Mr. LAUGHLIN. Thank you.

[Recess.]

Mr. OBERSTAR. The subcommittee will resume its sitting.

[Discussion off the record.]

Mr. OBERSTAR. On the record.

Mr. Kizer, you had some additional comments to make about the TCAS?

Mr. KIZER. Yes, sir. I just wanted to respond for the record to a question that Congressman Inhofe made and then also to add closing comments.

Congressman Inhofe inquired as to the capabilities of outside activities, repair stations to do the work that needs to be done with regard to TCAS. We did a survey and a research activity with regard to the available repair station resources prior to these hearings.

We have determined that there are approximately 22 repair stations that have the capability to do the work in one form or another. However, of those facilities, 30 percent cannot accept contract work at the present time, 50 percent only have one hanger available to do the work, and 25 percent have no STC (supplemental type certificate) authority.

So, that severely constrains the capability of those outside facilities for outside use.

Then, in closing, I would like to add that we need an operational evaluation both to make sure that we have a system that works and to make certain that we have pilots and controllers who have complete confidence in that system. An effective operational evaluation would require adequate time to do the evaluation, to learn from it, and to implement what we learn during the process with regard to the hardware but, more importantly, with regard to the software, our flight procedures, and with the air controllers.

If we don't do it properly, we could degrade safety. The most important thing we can do as advocates of TCAS is to make sure we get it right. Getting it done a little sooner is far less important than getting it done properly. This is equipment which, if not implemented properly, has the potential to cause accidents.

Starting installations as soon as possible is fine. Beginning the operational evaluation in 1990 is fine. But we are going to need until the end of 1993 to complete the installations if we are going to get the full safety benefit from the operational evaluation.

Mr. OBERSTAR. Let me interrupt you there. I can fully appreciate the need for an operational period of time to evaluate the effects, the operational effects of wide-scale application of TCAS.

I can fully appreciate the issues raised on page five of your testimony and those to which Captain Buly and Captain Gustafsson addressed themselves, the number of resolution advisories and traffic advisories that will occur in this. And you need to know how does the air traffic system handle it and how is it going to work in the real world under congested conditions. Fine.

Your ATA position is that there should be 15 percent, something in the range of 600 aircraft. On the high side, OTA says, oh, we think the closer you get to 30 percent, 1200, aircraft the better.

What is the difference in that, and what is your justification for a lower number?

Mr. KIZER. Well, the size of the sample base is predicated on upper and lower limits. The upper limit has to be one that allows adequate assessment of the findings in addressing the data that we collect from that sample base. So, that limits the number of aircraft that you can evaluate.

It also addresses the fact that the whole purpose for doing a sample in the first case rather than doing the whole fleet is to ensure that if there are problems, we can rectify those problems before we inundate the entire ATC system with those problems.

So, the upper limit of the sample has to be low enough so that you don't compromise the system for controlling aircraft; and, two, that allows you to retrofit the problem boxes in a reasonable period of time.

Mr. OBERSTAR. All right. I understand that.

If you had in this evaluation period 25 to, on the high side, 30 percent of the aircraft outfitted with TCAS, is it possible that that could cover as much as 80 percent of the high-traffic-density areas?

Mr. KIZER. Well, I am certain it could.

Mr. OBERSTAR. What kind of pressure is that going to put on those aircraft, though, that are outfitted with TCAS in that limited period of time? You are going to be flying those aircraft more intensively, aren't you, and aren't the airlines going to be scheduling those aircraft into those high-density areas?

Mr. KIZER. We can control that sample base to provide any type of mix that we want at any particular time in a given day.

Mr. OBERSTAR. All right. That argues for a higher percentage so you can vary your mix of aircraft and not put so much pressure on those operating with TCAS.

Mr. KIZER. No, I don't think so. I think what that says, Congressman, is that we have the opportunity with a smaller base to accomplish the same thing that we would try to achieve with a larger base just by controlling the aircraft, but by the same token should we find significant problems we aren't faced with rectifying those problems in a large number of machines.

Mr. OBERSTAR. OK.

Mr. KIZER. So, I think that the lower limit of the sample base has to be large enough to accommodate all of the interests that need to be evaluated, and that includes the controllers and the cockpit for the human factors issues.

Mr. OBERSTAR. And type and model of aircraft.

Mr. KIZER. That is correct.

I think that 15 percent represents a significant capability in that regard and allows us flexibility; 25 percent or greater, particularly with the problems that we envision in getting the supplemental-type certificates within the first year will push, if not exceed, the capability of the industry to provide that sample base before the end of 1990.

Mr. OBERSTAR. Thank you. That is helpful.

Mr. KIZER. Yes, sir.

Mr. OBERSTAR. Captain Buly, Captain Gustafsson, any further comments?

[No response.]

Mr. OBERSTAR. No supplementary remarks?

[No response.]

Mr. OBERSTAR. Thank you very much for your testimony. We greatly appreciate your participation and your insight into these issues.

Mr. KIZER. Thank you.

Mr. BULY. Thank you, sir.

Mr. GUSTAFSSON. Thank you.

[The prepared statement of Mr. Kizer follows:]

STATEMENT BY CLYDE RICHARD KIZER
VICE PRESIDENT - ENGINEERING AND MAINTENANCE
AIR TRANSPORT ASSOCIATION OF AMERICA
BEFORE THE AVIATION SUBCOMMITTEE
HOUSE PUBLIC WORKS AND TRANSPORTATION COMMITTEE
May 4, 1989

Mr. Chairman, my name is Clyde Richard Kizer. I am Vice President - Engineering and Maintenance for the Air Transport Association. I am accompanied today by Captain Robert Buley of Northwest Airlines and Mr. Ulf Gustafsson, United Airlines. Both gentlemen, among their many management responsibilities, serve as TCAS project managers for their companies. Both have been intimately involved with the cooperative government-industry TCAS program known as LIP - the Limited Installation Program. My remarks today will review the progress and concerns of the air transport industry regarding implementation of the Traffic Alert and Collision Avoidance System (TCAS II), in keeping with the requirements of Public Law 100-223, and relate those concerns to the conclusions and options contained in the special study conducted for the Congress by the Office of Technology Assessment. That study was titled "Safer Skies with TCAS."

BACKGROUND

Mr. Chairman, representatives of the Air Transport Association appeared before you on September 25, 1986. At that time, you served as Chairman of the Investigations and Oversight Subcommittee. Our 1986 testimony covered a broad range of measures needed to ensure safety of operation in the ATC system: carriage of altitude encoding transponders on general aviation

aircraft, provision of capability in ATC facilities for conflict alert for VFR Mode C intruders and conflict resolution advisories and the need for fundamental reform in the institutional framework within which FAA must operate. But the primary focus of that testimony was on TCAS development -- specifically, the progress that had been made in bringing TCAS II to an advanced state of development, results of early operational trials and problems remaining to be resolved.

Mr. Chairman, you are well aware of the interest of the ATA member airlines in development of an effective aircraft collision avoidance system. Indeed, the ATA initiated the original requirement for such a system in 1955. ATA member airlines have pursued a policy of cooperative involvement with manufacturers and government agencies in developing and testing appropriate technical specifications, certification guidelines and operational evaluation requirements. Our dedication and resolve have not flagged. But we must complete all the steps necessary to insure that the TCAS II systems we install in our airplanes function properly; we must not inadvertently - in haste - introduce some fault that might compromise rather than enhance safety; we must insure that our pilots and air traffic controllers have confidence in the system and can use it in the intended manner.

A fundamental principle needs to be restated to insure understanding of the role of TCAS II: the system is a backup to the services provided by ATC. The primary means of effecting separation assurance (collision avoidance) within the airspace of the United States will remain the services provided by FAA's Air Traffic Control System. Therefore, we must insure that TCAS

II is fully compatible with the ATC system and the rules and operating procedures which apply within that system.

LEGISLATIVE/REGULATORY FACTORS

The FAA issued a notice of proposed rulemaking (NPRM No. 87-8) regarding the Traffic Alert and Collision Avoidance System in August, 1987. Industry comments were due December 24, 1987. The Airport and Airway Safety and Capacity Expansion Act of 1987, PL 100-223, was enacted December 30, 1987. It included provisions requiring FAA certification of TCAS II equipment within 18 months of enactment (June 30, 1989) and installation of TCAS II on all aircraft with 30 or more seats within 30 months (December 30, 1991) after certification. These initiatives, along with the requirement for monthly FAA progress reports to Congress, have contributed enormously to the advancement of this important safety initiative. But problems attendant to the implementation schedule remain.

The NPRM comment period precluded input of findings and recommendations from the United Airlines and Northwest Airlines LIP evaluation flights, which did not begin until 1988. In addition, the final rule was published in January 1989, prior to the completion of the Northwest LIP.

The FAA published Technical Standard Order (TSO) No. C-119, "TCAS-II Airborne Equipment," on October 14, 1988. It serves as the performance standard to which manufacturers must produce TCAS II equipment acceptable to FAA. Advisory Circular (AC) 20-131, "Airworthiness and Operational Approval of Traffic Alert and Collision Avoidance System (TCAS II) and Mode S Transponders," was also published by the FAA in October 1988 to serve as the basis for airworthiness and operational approval of TCAS.

It was logical to expect that significant recommendations would result from the LIP evaluations, as indeed both LIP programs demonstrated. Unfortunately, the schedule precluded incorporation of LIP findings in the FAA rules, specifications and procedures governing TCAS II equipment in airline aircraft. We are now pursuing a "catch-up" program to update the TCAS performance standards and to complete technical specifications for TCAS II cockpit displays.

LIP: TECHNICAL/OPERATIONAL CONCERNS

The United Airlines LIP flights were conducted between January 30 and July 31, 1988 and United's evaluation report was issued on October 31, 1988. Northwest commenced LIP evaluation flights on September 21, 1988 and formally completed the flight program on March 31, 1989. The two Northwest MD-80 aircraft that participated in the LIP program continue to operate with TCAS II installed, thus providing additional data and opportunity for observers to become familiar with system operation. The Northwest LIP evaluation report will be issued in June, 1989.

Both United and Northwest Limited Installation Programs were highly successful and a number of changes needed in the TCAS II system were identified. These included modifications to the TCAS II collision avoidance logic. This logic is described in RTCA Document DO-185, which includes all the basic Minimum Operational Performance Standards (MOPS) for TCAS II. RTCA Document DO-185 is incorporated by reference in FAA's Technical Standard Order No. C-119 and thus the MOPS comprise an integral element in the technical description of a TCAS II system eligible for FAA certification. Change 6 to the RTCA MOPS for

TCAS II, which includes important changes to over 30% of the collision avoidance logic, is still being validated. FAA's flight tests to validate the Change 6 logic have slipped by four months and will not be completed before June, 1989. This is likely to result in delays in certification and initial equipment deliveries. Change 7 is under development and will incorporate additional modifications based upon United and Northwest LIP experience as well as some changes to facilitate international acceptance.

A substantial finding of the United LIP evaluation concerns the number of Traffic Advisories (TA) and Resolution Advisories (RA) encountered during the six month evaluation. Traffic Advisories alert the crew to aircraft proximity that might represent a potential threat, while Resolution Advisories dictate evasive maneuvering to ensure maximum aircraft separation when the TCAS computers determine that a flight path conflict exists. The United LIP findings resulted in 913 Traffic Advisories and 72 Resolution Advisories during the 2025 hours flown with TCAS active. About 80% of the Advisories occurred in high density air traffic areas. When extrapolated to full airline fleet operation, about 18,000 flights daily, Traffic Advisories would occur at the rate of approximately 18,000 per day and Resolution Advisories which could occur at the rate of 1000-2000 per day. It is apparent that this rate could have significant implications for flight crews and air traffic controllers, especially in high density traffic areas. Excessive numbers of RA's may produce cascade effects as pilots modify their flight paths in response to the warnings. System modifications may be required to eliminate unnecessary and

distracting advisories. In fact, United recommended such modifications in its LIP evaluation report.

Northwest Airlines LIP experience has been generally similar to that reported by United. Captain Buley is prepared to brief you on highlights of the Northwest program, including rates of resolution and traffic advisories, numbers of advisories in high density traffic areas, including the airspace surrounding Minneapolis-St. Paul International Airport and John Wayne - Orange County Airport, California, and operational concerns of flight crews receiving multiple advisories over a short time span and advisories received while conducting noise abatement takeoffs from John Wayne - Orange County Airport.

NEED FOR AN OPERATIONAL EVALUATION

It is absolutely essential that the operational effects of wide scale application of TCAS be evaluated in a structured program prior to full fleet implementation. This could best be accomplished by means of an operational evaluation which involves a significant, specified sample of TCAS equipped aircraft. The results of the evaluation would determine the need to revise ATC/cockpit procedures and/or suggest modifications to the TCAS II system to minimize the exposure to possible adverse operational effects. A one-year operational evaluation involving a 15% fleet sample, with concentration on short-haul aircraft, is recommended to achieve these ends. A fleet sample of that size, 500-600 aircraft, will insure that 25-30% of terminal airspace operations are conducted with TCAS II equipped aircraft.

As you know, The Office of Technology Assessment (OTA) recently completed a study required by Congress to address the

implications of the TCAS II certification and implementation schedule mandated in current law. In its study entitled, "Safer Skies With TCAS," OTA states:

> "There is widespread agreement in the aviation community that cockpit human factors and air traffic system effects need further attention. From the inception of TCAS, pilots, airlines, and manufacturers have been concerned about possible human factors implications of traffic displays, warnings, and maneuver advisories in the cockpit. While pilot responses to TCAS have been studied at the National Aeronautics and Space Administration (NASA) Ames Research Center and during the I.IPs, the full effect of TCAS on other pilot duties is unclear.
>
> "The reactions and interactions of pilots, controllers, and TCAS will affect the safety and operation of the entire ATC system. While the air traffic system can be modeled to include TCAS on a simple basis, the human dimension escapes prediction. Using past and predicted traffic patterns and TCAS detection and avoidance algorithms, the number and extent of TCAS alerts, warnings, and conflict resolution maneuvers can be studied along with the potential for electromagnetic interference. However, pilot and controller performance could change due to TCAS, ranging from complacency to interference with normal duties. The following issues need to be more fully addressed: 1) changes in the amount of pilot/controller communications; 2) pilot/controller attention to other duties due to workload or complacency; and 3) the effect of pilots using or reacting to TCAS information outside design boundaries - maneuvering in traffic without an RA or over/underflying an RA.
>
> "OTA concludes that an evaluation program that includes early implementation of TCAS in a substantial portion of the fleet would benefit safety. Without such a program, the worst case scenario is that the airlines could completely outfit their fleets only to learn that a technical glitch requires major modification of the current TCAS equipment. A structured evaluation phase would allow problems to be identified early, preventing further installation of flawed units and permitting modifications soon enough in the installation program to minimize costs."

The OTA study underscores the importance of conducting a comprehensive in-service evaluation. The ATA recommendation is consistent with that finding. It would require that the installation of TCAS II equipment be initiated as soon as each aircraft type and model is certified by FAA. This process cannot begin until early next year and will require issuance by

the FAA of approximately 150 supplemental type certificates. This process is expected to take 10-12 months. In the meantime airlines will have committed to a continuous installation of TCAS II provisions (radio racks, antennas, cables, etc.). Following a successful operational evaluation, subsequent equipment installations would require the installation of approved avionics boxes and cockpit instrumentation.

To be effective the proposed operational evaluation would necessitate participation by all segments of the air transport industry concerned with the results. This should include, but not be limited to, the FAA, the airlines, aircrew members, air traffic controllers, aircraft manufacturers and equipment manufacturers. ATA has organized a cooperative effort to define an effective operational evaluation program. The activity is underway, in close cooperation with FAA, and is chaired by Mr. Gustafsson.

IMPLEMENTATION SCHEDULE CONCERNS

During the past year ATA airlines provided implementation schedule information in response to both OTA and ATA requests for such data. These schedules represented "best effort" implementation plans based on individual airline fleet size and production capacity for approximately 3800 aircraft requiring modification. For the larger operators this data represents dedicated TCAS II modification lines. This method of modification allows the most efficient use of available resources.

All airlines responding to these inquiries agreed that the current compliance date, December 30, 1991, represents an unrealistic target in terms of assured 100% fleet compliance.

There are inadequate facility and manpower resources to meet all competing maintenance and modification requirements within that time frame.

Turning again to OTA's findings:

> "The airlines must install windshear warning systems and undertake major maintenance on older aircraft during the same period as they install TCAS II. The same technicians will be used to install windshear systems, and accomplishing other cockpit work will be difficult because of limited space. Maintenance of aging aircraft will also draw on ramp and hangar space. OTA finds that out-of-service time and economic penalties due to TCAS II will be compounded by the windshear and aging aircraft requirements.
>
> "TCAS II installation would be least disruptive for airlines if it could be accomplished during the normal heavy maintenance cycle that occurs about every 4 years for each aircraft. However, the December 1991 deadline leaves the airlines only 2 years for fleetwide implementation, because production equipment of TCAS II will not be available until December 1989. To complete the work in 2 rather than 4 years will require airlines to hire additional labor, schedule more overtime, and take more aircraft out-of-service time. The increased workload may cause sequencing problems with other programs, such as aging aircraft requirements and windshear equipment installation.
>
> "Out-of-service time for aircraft raises equity issues for the various airlines. Some of these equity issues are separate from the direct costs of installing TCAS II. Airlines without any extra aircraft may have to eliminate some flights for short periods. These airlines are likely to lose passengers to other airlines, whereas companies that have extra aircraft in their fleets or the resources to lease them can avoid canceling any service. In addition, some communities served by airlines without extra aircraft may be inconvenienced during down time for the aircraft that normally serve them."

It is clear that many airlines lack sufficient capacity to complete the installations and will have to seek contracts with outside repair facilities and modification centers. It is estimated that approximately 650 aircraft that otherwise would not be taken out of service will have to be grounded in order to meet the December 30, 1991 compliance date. The economic impact to the industry and disruption for air travelers due to this

excessive aircraft out-of-service time is unwarranted. Such a burden would also not be shared equitably by the airlines.

Approximately 19,000 aircraft days out-of-service will be required to accomplish the TCAS installation (an average of 4.9 days for each of 3,800 aircraft). The modification requires 500-1000 manhours per aircraft and about 1000 hours of engineering work for each aircraft type and model. The OTA study also says that about 1000 technicians will be needed to meet the TCAS workload without overtime or cutting back on other maintenance activities.

The loss-of-service impact to the traveling public could be reduced significantly if the compliance date were more closely matched to existing production capacity. The ATA airlines report that their best effort planning shows that a compliance date of December 30, 1993 is the most rational in terms of achieving 100% compliance for the industry and minimizing impact on the traveling and shipping public.

The OTA study results also demonstrate that revision of the compliance date to December 30, 1993 is necessary to permit a 12 month operational evaluation to be conducted, followed by a phase-in of TCAS II modifications at a rate of about 800-1000 aircraft per year.

FACILITY AND MANPOWER CONSTRAINTS

The major impediment to earlier compliance relates to limited technical manpower and fixed maintenance facility resource. Airlines do not have hangar/dock capacity and mechanic work forces excess to their needs. Recent growth of the airline fleet and the increased maintenance requirements of older aircraft, necessitating large scale structural work as

well as other aircraft modifications such as windshear alerting and guidance, have stressed existing capacity to the limit. These maintenance resource limitations have forced many airlines to seek outside repair facilities and modification centers to accommodate maintenance workload. A majority of the ATA member airlines are sending work outside due to the lack of sufficient internal capacity. Many airlines who used to have excess maintenance capacity which they contracted out to other airlines can no longer do so.

A survey of the capabilities of existing repair stations and modification centers indicates a small number that have the capacity and engineering skills required for the TCAS installation. One major airline indicated that of the five outside facilities that responded to a request for bids for TCAS installations, one was considered to be unqualified. The airline subsequently contracted for the full capacity of one of the remaining bidders.

Even more acute than fixed facility constraints is the lack of adequate specialized technical manpower required to meet the current TCAS compliance date and other required avionics retrofit programs. Radio and electronic (R&E) and structural mechanic skills are in high demand and short supply. Recent data collected from 14 ATA airlines indicates that they all lack R&E manpower and have been unsuccessful in hiring mechanics at the rate needed. In total, these airlines are short more than 4000 mechanics to their current needs. These are hiring needs that have been approved and funded, but for which there are inadequate numbers of qualified candidates.

Part of the need for additional technical mechanic resource results from the regulatory requirement for the installation of windshear equipment in all transport category aircraft. This requirement impacts mechanic shortages as well as facility shortages since that implementation schedule is inconsistent with the TCAS installation schedule. This results in redundant and inefficient use of existing resources for similar programs on a conflicting schedule.

Mr. Chairman, you and various other members wrote the FAA late last year, inquiring about this very problem. The Administrator, in his response dated February 10, 1989 stated:

> "You asked whether it would be more efficient if there were congruence between the installation timetables for TCAS II and the windshear alert and flightpath guidance equipment we have recently mandated for U.S. airlines. This would certainly be the case. You may recall that our originally proposed timetable for windshear equipment installation was only 2 years. Following that proposal, the Congress enacted Public Law 100-223, which set a firm December 30, 1991, deadline for TCAS installation. Shortly thereafter, we concluded that it would not be possible to meet both the original 2-year windshear equipment installation schedule and the Congressionally mandated deadline for TCAS installation. In view of this conflict and recognizing our inability to extend the statutory TCAS installation deadline through regulations, we enacted provisions in our windshear equipment rule which provide considerably more than a 2-year installation period for those airlines which can demonstrate the need for such an extension. Today, with the benefit of more knowledge and experience in both the TCAS and windshear equipment installation areas, it is clear that even the existing windshear equipment installation deadline is going to be very difficult to achieve on the part of some airlines, though we continue to believe that schedule can be met. There is no doubt in our minds, however, that it would be far more efficient to have the two installation schedules identical.
>
> "You also asked our views on the need for a TCAS phase-in period, during which safe system design can be verified, operational reliability can be demonstrated in actual service, and unexpected air traffic control system interactions can be analyzed. As your letter implied, undue haste in mandatory retrofit of the ground proximity warning system and the emergency locator transmitter in the past led to confusion and frustrations which could have been

avoided with such a phase-in period. As you know, the TCAS is one of the most tested pieces of avionics ever developed. Over the past several years, the FAA and industry conducted limited installations and tests of prototype TCAS hardware with Piedmont Airlines, United Airlines, and Northwest Airlines. Over 2,000 hours of actual flying were done with the first two programs, and the Northwest effort is still underway. In summary, TCAS is a well proven system in which we have great confidence.

"Nevertheless, it is a virtual certainly that small unforeseen difficulties will arise when large numbers of aircraft are equipped with and using TCAS. Were it not for the statutory TCAS installation deadline, we would propose a phase-in period by regulation. With such a phase-in period provided for, we would also be able to make the windshear and TCAS schedules compatible and gain the benefits we discussed above."

The current windshear schedule results in excessive demand for technical manpower which is not available. Industry resource constraints and the interests of the traveling public would be best served if these two avionics installation programs were placed on the same completion schedule so as to minimize aircraft out of service time and maximize the use of existing maintenance resources. The experts of our industry believe that the most rational timetable should not call for 100% compliance for these programs prior to the end of 1993.

In response to the urgent need for R&E mechanic skills many airlines are attempting to train their Aircraft and Powerplant (A&P) mechanics to fill those needs. The increased training demands and the influx of large numbers of inexperienced new mechanics will result in significant reductions to production efficiency since the best mechanics will be recruited as instructors and other experienced mechanics will be required to supervise the activities of the newer, less experienced mechanics.

Approximately 2-3 years of formal and on the job training is required to achieve full productivity from a recently

schooled mechanic. Under the current schedule, newly-hired mechanics would be just reaching their productivity potential at the time the TCAS II and windshear modifications were being completed and the labor force would then be excessive to the need. It would be more rational to revise the compliance period to more nearly match the existing labor force. This would minimize the disruptive impact on the workforce of peaking, followed by decline in work force demand.

In addition to shortages of mechanics, the airlines and the manufacturers are experiencing shortages in engineering staff. These shortages are particularly acute for airlines who depend on the aircraft manufacturer to provide technical guidance for TCAS installations in the form of service bulletins. The manufacturers must address TCAS II installation requirements for new, production line aircraft on a priority basis so as to meet the December 30, 1991 compliance date. They have already advised the airlines that service bulletins for out-of-production aircraft will not be available. Manufacturers will only be able to provide service letters, which lack the specific engineering detail required for system certification by FAA. A revised compliance date would allow the manufacturers to redistribute their engineering workload and priorities so as to more adequately address needs for technical detail for all aircraft types and models.

THE COMPLIANCE DEADLINE

The OTA concluded that Congress should consider amending PL 100-223 to extend the current deadline.

> "OTA concludes that the TCAS II compliance deadline established in Public Law 100-223 (TCAS section) has some safety, economic, and international consequences not fully

> foreseen at the time of enactment. The TCAS II requirement is unique in the combination of technological complexity, rapid implementation, and the number of aircraft affected. Moreover, the extensive maintenance requirements associated with the aging of the national fleet were not anticipated when the legislation was enacted. Maintenance for aging aircraft will place severe demands on airline personnel and facilities resources concurrently with those needed for TCAS II."

Moreover, the FAA said in its February 10, 1989 letter to you and other members:

> "Any decisions which are to contribute to an adjustment in the TCAS schedule should be made as soon as possible at the outside. A year or more from now, any schedule changes could literally be chaotic, with uneven and potentially unfair effects on different airlines."

The question that remains relates to the length of extension. Part of that answer rests with the proposed operational evaluation. That evaluation will require the dedicated effort of a significant portion of the industry's technical and operational staff if it is to be completed thoroughly and effectively.

It is imperative that significant findings of the LIP evaluations be incorporated in the final TCAS configuration. We need Changes 6 and 7 incorporated in the Minimum Operational Performance and Standards described in RTCA Document DO-185. This can only be accomplished if the compliance date is revised.

The airlines recommend revision of the compliance date to December 30, 1993. Such a revision would enable FAA and the industry to complete a comprehensive operational evaluation. Any compliance date earlier than that would adversely impact the ability of airline technical and operational personnel to participate in an effective evaluation since that same staff will be required to complete certification and installation requirements and to train all the pilots just to satisfy the

TCAS implementation deadline. An earlier compliance date would also preclude the opportunity to benefit from whatever lessons are learned during the operational evaluation. There will not be adequate time to incorporate any changes needed in the TCAS II system. The only alternative under an earlier compliance date will be to install early version TCAS II avionics, then remove the systems later, modify them and reinstall the equipment. Such a retrofit scenario would be unnecessarily expensive, would result in an airline fleet with differing capabilities and would inevitably have an adverse impact on pilot and controller confidence in the TCAS II system. It would also delay our goal of reaching a mature, stable TCAS II system.

An additional beneficial effect of a revision of the compliance date to December 30, 1993 would result from the opportunity this gives foreign carriers to integrate ICAO requirements with the FAA regulatory action and to introduce any modifications resulting from U.S. service experience. This would likely provide the time required for those carriers to complete TCAS implementation within their own fleets in an orderly manner, consistent with the requirements of their own airworthiness authorities. It would also help insure that all TCAS II equipment operating in U.S. airspace conforms to uniform standards.

Best effort production planning indicates that a compliance date of December 30, 1993 is the most rational in terms of completion of operational evaluation, incorporation of any needed changes in TCAS II and efficient use of available manpower and resources. Moreover, regulatory requirements for the installation of TCAS and windshear equipment could be made consistent as has been advocated by the FAA.

SUMMARY/CONCLUSION

The ATA airlines are strong advocates for rational implementation of TCAS II equipment in the air transport fleet. TCAS II will contribute significantly to increased safety in air travel. It is crucial that the implementation of TCAS II be accomplished in a manner consistent with the dedicated effort that accompanied the development of the system. It is essential that an operational evaluation be conducted involving a significant sample of the existing air transport fleet to determine the effects on existing ATC and cockpit procedures - especially in high traffic density areas. The requirement for an operational evaluation combined with the need for incorporation of needed TCAS II system changes, efficient use of aircraft maintenance time, maximum use of available modification facility and technical manpower resource, and the desirability of minimizing the impact to the traveling public all support the need for a revised implementation and installation schedule, leading to 100% compliance by December 30, 1993.

We recommend:

- That TCAS II installation begin during early 1990 as soon as FAA certificates systems and production equipment becomes available;
- That a phased installation be implemented to permit a comprehensive one-year, in-service evaluation involving about 15%-20% of the U.S. civil fleet (approximately 500-600 aircraft);
- That the current compliance date be revised to permit installation to be completed by December 30, 1993.

These recommendations promise numerous benefits:

- The overall safety of the current air transport system in the U.S. will be assured by pursuing a technically sound installation schedule progressing to 100% compliance by the end of 1993;
- A comprehensive in-service evaluation can be conducted to determine the effects of TCAS on controllers, pilots and the air traffic control system;
- Adequate time will be available to resolve technical or operational problems identified during the operational evaluation with minimal impact to TCAS production and installation schedules;
- Efficient use of existing facility and technical manpower capacity will be possible;
- The number of aircraft taken out of service will be minimized with reduced inconvenience and disruption for air travelers;
- The capability of manufacturers and airlines to assure the highest standards for quality control will be substantially improved;
- Sufficient time would be allowed to resolve technical and operational issues through ICAO so that international carriers could implement TCAS based upon common standards.

Mr. Chairman, we need your assistance to assure that the safety objectives of the TCAS II system are fully realized. The Federal Aviation Administration, Congress and the industry should work together to revise the current statute and take necessary administrative steps to combine the TCAS II

installation and implementation timetable with other ongoing regulatory requirements related to aircraft maintenance and overhaul. Working together we can assure safety, cost efficiency and minimum disruption for air travelers.

Captain Buley, Mr. Gustafsson and I are prepared to answer any questions you may have.

Mr. OBERSTAR. Our next witness is Mr. Jack Howell, chairman of the Air Traffic Control Committee for the Air Line Pilots Association.

Would you introduce Mr. O'Brien?

TESTIMONY OF JACK HOWELL, CHAIRMAN, AIR TRAFFIC CONTROL COMMITTEE, AIR LINE PILOTS ASSOCIATION, ACCOMPANIED BY JOHN O'BRIEN, DIRECTOR, ENGINEERING AND SAFETY DEPARTMENT, AIR LINE PILOTS ASSOCIATION

Mr. HOWELL. Yes, sir. This is Mr. John O'Brien. He is the Director of our Engineering and Air Safety Department at the Air Line Pilots Association.

I would like for the entire statement to be entered into the record.

Mr. OBERSTAR. Without objection, it will be so ordered.

Mr. HOWELL. Thank you.

Mr. Chairman, I am Jack Howell, Chairman of the Air Traffic Control Committee for the Air Line Pilots Association, and I just introduced Mr. O'Brien. We would like to commend you for holding this hearing today as it appears that this is a very good time to step back to assess just where we are in the TCAS program.

In commenting on this subject, I will address what we see as three major areas of concern: the program delay, an operational evaluation program, and some other considerations related to TCAS III.

First, as you know, Mr. Chairman, the special report covering the TCAS program issued by the OTA concluded that a phased implementation schedule for TCAS II would be in the best interests of the aviation industry. We realize that in reaching this conclusion, OTA had some very tough calls to make, and certainly their recommendations must be seriously considered by the Congress.

But as pilots, we are acutely aware of the need for an effective airborne collision avoidance system. Now, your subcommittee will be faced with an even more difficult decisionmaking process when you consider what to do with that OTA report.

Perhaps the most effective way for you to deal with the implementation issue is to focus on the initial driving force that caused Congress to require TCAS equippage of the air carrier fleet.

While this decision was based on overall safety considerations within the national airspace system, the midair collision over Cerritos, California, in August of 1986 was the single event that caused this action to be taken.

Realizing that, the question has to be asked: Has that threat been eliminated, or can we afford to relax the program at the expense of the flying public?

While you contemplate this question, I should like to bring to your attention that recently two very critical near midair collisions involving air carriers have occurred. The first event happened in Baton Rouge, LA, on March 18 and involved an air carrier and a general aviation aircraft in a head-on encounter.

The second event involved two air carriers, one of which was a Boeing 747 on final approach at Kennedy in New York on April 23 with both aircraft vying for simultaneous use of the same runway

for landing. Common to both of these events was the fact that all four aircraft were under ATC control. Yet those collisions were prevented only through the grace of God in the Kennedy case and by quick pilot reaction in the other. These are precisely the type of events that TCAS was designed to prevent.

Another consideration for you should be what improvements can and should be made to TCAS during the course of any delay, if one is granted. Improved logic and miss-distance filtering are two that quickly come to our minds. Another would be possible operational changes based on the findings of a formalized evaluation period. And this brings up our second major area of concern.

As you know, the OTA report identified a critical and immediate need for an operational evaluation program. Such a program is also described in H.R. 2151, and we believe that such a program is the most critical element of the OTA conclusions and H.R. 2151.

We have some specific thoughts on how such a formal evaluation should be structured, and I would like to give them to you now:

One, participation in the evaluation should consist of a minimum of a 25 percent cross-section of each operator's fleet;

Two, the major thrust of the evaluation should focus on a mix of aircraft in busy terminal areas; three, there should be no level-off of TCAS installations during the evaluation; four, a 6-month evaluation should be adequate if no significant problems are identified; and five, an industry working group should be established to define exactly what is required to answer the outstanding operational questions relating to both the air side and ground-based ATC system concerns. It does not appear that the ground-based phase of the evaluation has received the attention it requires.

There are two other items that could affect the timeliness and quality of the evaluation. The first is the TCAS system certification for each operator of the FAA. If you ask any of the TCAS manufacturers what they believe to be the biggest stumbling block in the implementation program, I am sure they will respond: the certification process.

We believe that unless this problem is addressed head on by the FAA and unless more resources are committed to the certification workload, any implementation you establish may be purely academic.

The second item is funding for 60 airborne recorders to be used in that evaluation. It is our understanding that while the FAA has been authorized to procure this equipment, no funding has yet been allocated for it. Hopefully, this shortfall can be quickly resolved and the equipment procurement can begin.

The third major concern we have relates to the progress of TCAS III. As you know, Mr. Chairman, we pilots still firmly believe TCAS II is only an interim system and that the operational flexibility provided by TCAS III is essential if the traveling public is to receive the maximum degree of protection TCAS is capable of providing.

TCAS III has more accurate bearing information than does TCAS II, and several advantages arise from this. The first is that a more accurate threat assessment can be made and a lower unnecessary alert rate results.

The second advantage is that TCAS III can recommend a horizontal resolution maneuver.

And lastly, since normal ATC horizontal separation standards are much larger than vertical standards at a ratio of almost 18-to-1, a horizontal displacement by an aircraft executing a horizontal resolution maneuver is much less threatening to the order of the ATC system than would be a corresponding resolution maneuver in the vertical plane.

The absence of this horizontal resolution capability in TCAS II has required revisions to the vertical escape maneuvers that are totally inconsistent with pilot reactions and highly questionable from an aircraft performance standpoint.

One particular item relating to TCAS III that we question is contained on page seven of the January 1989 TCAS report of the Secretary of Transportation to Congress, as required under Public Law 96-193. This particular item shows over a one-year lapse between the time that TCAS III MOPS is drafted and the beginning of a TCAS III limited installation program in 1991.

We believe that in view of the past and ongoing testing of TCAS III by the FAA technical center, this period of time is excessive and should not be necessary. Hopefully, you will have the opportunity to ask the FAA to justify this delay.

In summary, Mr. Chairman, we believe that TCAS equipment should be installed as soon as certified and available; that the air carriers should be required to participate in an operational evaluation program in a timely manner with a sufficient percent of their fleets to assure valid results; and thirdly, that you should discuss TCAS III milestones with the FAA to ensure that TCAS III receives the attention needed to reach completion and installation in the air carrier fleet.

I thank you, sir, and Mr. O'Brien and I will be pleased to comment on any questions you might have.

Mr. OBERSTAR. Well, Mr. Howell, while it may be a little bit of an overstatement to say that the Cerritos collision caused the action, it was the triggering factor, I think, that spurred the act of legislation. There were many other incidents leading up to that point.

Clearly, there was going to be regulatory action taken, I felt, at least from the hearings that I conducted in the Investigations and Oversight Committee. And it was only the cruelest of coincidence that a year prior to Cerritos that testimony and an exchange with Admiral Engen I asked when the FAA was going to order TCAS installed on aircraft, and he said, "We will take that step when safety becomes a factor. It is not now a factor."

And my reaction at the time was a bit of annoyance and perhaps assessment of the pace at which FAA was moving on other things, that, "With the speed with which FAA takes actions on these matters, people will die in a midair collision before you issue that order."

And we scheduled a hearing on TCAS in September, just 1 week—a month before the event occurred—1 week after Cerritos.

In my judgment, the next midair collision will be the Exxon Valdez of civil aviation. There will be such a public clamor and

outcry. People will want to know, and they will have the hides of all of us who haven't acted. And rightly so.

FAA is working mightily. Airline pilots are working vigorously. Airlines, I am convinced, are committed to safety. I think everybody is concerned that we do the right thing in this TCAS issue. The gentleman from California, Mr. Packard, I think, as the author of the legislation which he offered against a background of frustration that the pace of things wasn't moving fast enough. All of us want the technology in place, we want it to do what it is intended to do, we want to make sure that it works.

And I think you raised the proper questions about the evaluation period. Previously—and I am purposely stating issues and questions and framing them in stark terms or as stark as I can because I think this is the forum in which to ask those questions and the forum in which the answers have to be provided—the previous panel, about the level of participation.

You are suggesting that it should be a minimum of 25 percent cross-section of each operator's fleet, including the regional carriers. Is there anything particularly significant, scientifically crucial about a percentage level?

Mr. HOWELL. There should be. There probably can be. But that has not yet been accomplished. The committee chaired by Mr. Gustafsson, whom you met a few moments ago, should be capable of giving us that answer. Until then, we will have to go with our best feel. And for us, I think that number, 25 percent, is good because it does not leave such a major gap between that amount of implementation and the remainder of the fleet to be fitted before the time line expires.

Mr. OBERSTAR. So, once we pick a number, and if we go that route and the Congress puts a number, percentage number, into law and it acquires a status and a stature that is the equivalent of granite. Whether we should have some flexibility in that number is the question we have to think through carefully.

It certainly seems to me no less than one-fourth of the fleet and somewhere in the upper range of whatever it is to be sure, and I think you put your finger on it very rightly, a cross-section of the fleet. We want a tight model of aircraft so that in all circumstances you have an idea of what works and what doesn't and what are the problems to fix.

You are suggesting that the operators might interrupt the TCAS installation process. Under what circumstances? What indications do you have now, what vibes do you feel that lead you to make that statement?

Mr. HOWELL. Looking at the diagram of the OTA report, you will see a leveling off of the installations of TCAS for the duration of the operational testing and evaluation. It is our feeling that there need not be any leveling off of the installation of TCAS.

Others have talked about the fact that the wiring, and the racks can be continued to be installed, but the boxes would not be installed nor turned on. It is our feeling that that should not occur. There should be no leveling off in the implementation graph to accommodate the evaluation period, and certainly not if that evaluation period is going to extend for as long a period as a year.

Mr. OBERSTAR. Is it necessary to have a 2-year extension of time?

Mr. HOWELL. That is a very tough call to make without the value of the operational testing and evaluation that might occur. If we automatically say that a 2-year extension is granted, then compliance will be geared to that date, we feel. It is——

Mr. OBERSTAR. There is no question about it. That is exactly what happens.

Mr. HOWELL. Yes. We humans do that. If I say I am going to mow the lawn by Friday, it will be Friday till I get around to mowing the lawn.

On the other hand, adhering to the original deadline maybe unrealistic as well. So, if an arbitrary date has to be picked, and many people have said that we've got to do something so that we all have a goal to work toward, maybe that one year is right.

It offers an opportunity to balance out three items: the risk to the traveling public, the burden on the airlines, and the evolution toward perfection of TCAS. And with those three things in mind, maybe the one year is the right period of time to take care of some of those misgivings.

More importantly, however, in the implementation schedule is that OT&E, that operational testing and evaluation. If all goes well, we might be able to accelerate the installation. And of course, on the other hand, if things are found early in that program that are going badly, an extension might be necessary to be granted.

But far and away for us, while we do all of that, we have got to push on with TCAS III because therein lies the best solution.

Mr. OBERSTAR. Well, TCAS III is, yes, a technology still in development. And for my part, I have not wanted to delay installation of TCAS II while we wait for the next generation of technology. Let not the perfect be the enemy of the good.

I will have further questions. At this point I will yield to the gentleman from California.

Mr. PACKARD. I appreciate your last comment, Mr. Chairman, because we are also—at least this member is—very anxious that we move forward, and I believe in the original bill that now is law, it does call for TCAS III to move forward. And so we certainly recognize the interest of the pilots and others, the airlines and everyone, in moving to TCAS III. And I will certainly monitor that myself as we progress with the research and development.

One question I have—the chairman asked most of what I had—but the one question that I had:

If the airlines are required to take flights off schedule in order to meet the deadlines of the existing or the new bill, or the new law that we are proposing, by a tight schedule—in other words, they have to take several flights out of service in order to accommodate the retrofitting schedule—will that affect the pilots and their jobs, their working schedule, et cetera, et cetera?

Mr. HOWELL. Yes, sir. I think any time that you take flights out of a system, the air crews are definitely going to be involved and will be negatively impacted from that.

Mr. PACKARD. Does that give you concern by a short time frame, or would that have any influence on your determination or your testimony relative to a final deadline?

Mr. HOWELL. Given, sir, that we need to keep also in mind the need for minimizing the risk to the traveling public, I would not consider that to be an overriding matter.

Mr. PACKARD. I appreciate that.

So, your testimony is that pilots probably would accept as a group, and you being their spokesman would accept, a 1-year extension, you would look with disfavor on a 2-year extension. Is that what I have heard?

Mr. HOWELL. Yes, sir.

Mr. PACKARD. That is all I have, Mr. Chairman. I don't want to lengthen the hearing. It is already going late.

Mr. OBERSTAR. You made a statement on page seven, point five in your testimony, "An industry working group should be established to define exactly what is required to answer the operational questions," et cetera.

What do you mean by an industry working group, and how do you envision it operating?

Mr. HOWELL. We are well on the way to doing that, in our view, by following along the guidelines provided by Mr. Gustafsson and his group, the Joint Separation Assurance Task Force that has been in existence for some number of years. If we can crystallize that and get that to be the representative body, I think we can do well.

Mr. O'BRIEN. Just one more point. That group has started the process, as Jack just explained. But we see a lack of participation or significant participation by the air traffic services part of FAA.

There have been claims made that TCAS might have some negative effects on the overall air traffic control system: controller workload, unnecessary maneuvering, saturation of the ground-based computers, dropped targets.

Those questions need to be examined in this operational test and evaluation program as well as the airborne questions. To do that effectively, we need the air traffic services within FAA to participate within this working group and to identify their concerns so we can address them in the operational test and evaluation program.

Mr. OBERSTAR. Well, I am still trying to understand whom you include in the term industry working group. Are you talking about the airlines, talking about the manufacturers?

Mr. HOWELL. Yes. Essentially all of those, yes, sir. A collection of houses which would include the airlines, the manufacturers, pilot associations, hopefully controllers, and all aspects of the FAA to an even greater degree.

Mr. OBERSTAR. Now, you said such a group is in fact being assembled. Is that something that needs to be addressed in legislation? It seems to me that this is something that ought to be done just informally, but nonetheless effectively, and driven perhaps by FAA as something that they ought to initiate and call all these folks together.

Mr. HOWELL. We would agree with your observation. Not necessary for legislation, but indeed we are fairly well along now on the path toward achieving that group.

Mr. OBERSTAR. Good.

Well, we may include in report language direction to address that aspect of the issue.

What do you mean that the ground-based phase of evaluation has not received the attention needed?

Mr. HOWELL. As Mr. O'Brien has said, we have concentrated so long in making sure that the airborne elements communicate and cooperate with one another, that we may have, at the expense of the ATC, the ground-based ATC system, not provided enough insight as to how the systems in large numbers might affect their normal operations.

Example: If you had a busy terminal area and a large number of resolution advisories were occurring in that busy terminal area, it might provide an excessive amount of radio communications, getting the people advised on the ground that a resolution advisory had been posted.

Mr. O'BRIEN. That's right.

Mr. HOWELL. These kinds of things need to be investigated. We don't need more workload in a busy terminal area.

Mr. OBERSTAR. Is that something that needs to be included in the evaluation period?

Mr. HOWELL. Yes, sir.

Mr. OBERSTAR. It is a concern that has been expressed to me earlier by air traffic controllers. And of course, one of the concerns of the FAA, which for a very long time did not want to let go of the ground-based control, but are very concerned, and rightly so in certain instances, that in response to airborne warning, aircraft moves in this very congested area and may cause some other problems.

So, you have to have this conversation back and forth between the controllers and the aircraft, and you have only a 30-second response time or so from the time you get a warning on that piece of equipment for the captain to act on that information. He may not have time to communicate with the ground-based controller.

Mr. HOWELL. Exactly, sir. And that's why simulator training is so important. We need to know how to fly those maneuvers and how to stop them and restore order. And that can best be practiced in the simulator.

Mr. OBERSTAR. So, this evaluation period, you really believe that a good deal can be accomplished? You don't downgrade the evaluation period?

Mr. HOWELL. No, sir. I think it's a very significant element.

Mr. OBERSTAR. And you feel that it will contribute to an increased level of confidence among the flight deck crew?

Mr. HOWELL. Yes, sir. And it should lead to further refinements of the technology.

Mr. OBERSTAR. All right. That is very, very helpful. We greatly appreciate your testimony. Thank you very much.

Mr. HOWELL. Thank you, sir.

[The prepared statement of Mr. Howell follows:]

STATEMENT OF

JACK HOWELL, CHAIRMAN

AIR TRAFFIC CONTROL COMMITTEE

AIR LINE PILOTS ASSOCIATION

BEFORE THE

HOUSE AVIATION SUBCOMMITTEE

MAY 4, 1989

COLLISION AVOIDANCE TECHNOLOGY

Good afternoon, Mr. Chairman, I am Jack Howell, Chairman of the Air Line Pilots Association Air Traffic Control Committee. With me today is John O'Brien, the Director of our Engineering and Air Safety Department. ALPA currently represents the professional interests of 41,000 pilots who fly for 47 airlines.

We would like to commend you for holding this hearing today as it appears this is a good time to step back and assess just where we are in the TCAS program. In commenting on this subject, I will address what we see as three major areas of concern: program delay; an operational evaluation program; and other considerations.

First, as you know, Mr. Chairman, the special report covering the TCAS program issued by the Office of Technology Assessment (OTA) concluded that a phased implementation schedule for TCAS II would be in the best interest of the aviation industry. Specifically, the deadline for equipage of the Part 121 air carrier fleet should be moved from December 1991 to December 1993. We realize that in reaching this conclusion, OTA had some tough calls to make, and certainly their recommendation must be seriously considered by Congress. As pilots, however, we are acutely aware of the need for an effective airborne collision avoidance system. In our opinion, however, TCAS II as presently defined does not meet our operational requirement for an effective airborne collision avoidance system. That is why we strongly urged that the TCAS II system be upgradeable to TCAS III performance standards and that the FAA continue TCAS III development and operational testing.

Your subcommittee will be faced with a difficult decision-making process when you consider what to do with the OTA report. Perhaps the most effective way to deal with the implementation issue is to focus on the initial driving force that caused Congress to require TCAS equipage of the air carrier fleet. I think you will have to agree that while this decision was based

on overall safety considerations within the national airspace system, the midair collision over Cerritos, California, in August 1986, was the single event that caused this action to be taken. Realizing that, the question has to be asked -- "Has that threat been eliminated, and can we afford to relax the program at the expense of the flying public?"

While you contemplate this question, I should like to bring to your attention that recently, two very critical near-midair collisions involving air carriers have occurred. The first event happened at Baton Rouge, Louisiana, on March 18, and involved an air carrier and a general aviation aircraft in a head-on encounter. The second event involved two air carriers, one of which was a Boeing 747 on final approach to Kennedy Airport in New York, on April 23. Common to both of these events was the fact that all aircraft were under ATC control, yet collisions were prevented only through the grace of God in the Kennedy case, and quick pilot reaction in the other. These are precisely the type of events TCAS was designed to prevent!

We acknowledge that the events I just described represent one viewpoint to be considered in your decision-making process. Another consideration, however, should be what improvements can

and should be made to TCAS during the course of a delay, if one is granted. Improved logic and miss distance filtering are two that quickly come to mind. Another would be possible operational changes based on the findings of an evaluation period. This brings up our second major area of concern.

As you know, the OTA report identified a critical and immediate need for an operational evaluation program. Such a program is also described in HR 2151, and we believe that such a program is the most critical element of the OTA conclusions and HR 2151. It is obvious to us that some experience will be gained when the very first operational TCAS is placed in service on a line aircraft. Pilots will notice and report system deficiencies, airline maintenance people will do the same from their perspective, and I am confident air traffic controllers will be quick to identify any irregularities they detect. The magnitude of this input will continue as fleet equipage increases.

We also realize that it will be beneficial to have a specific number of aircraft equipped prior to a "formal evaluation" so a more accurate assessment can be obtained of how TCAS in busy terminal areas will impact the ATC system, and about how the Mode S data link exchange between TCAS equipped aircraft is working.

We have some specific thoughts on how such a formal evaluation should be structured that we would like to share with you!

1. Participation in the evaluation should consist of a minimum of 25 percent cross-section of each operator's fleet, including, of course, those regional commuters required to equip. Of course, some operators may increase their percentage above this number, but such increases would not be allowed to compensate for a company who has not yet acted on the equipage requirement as mandated a year and a half ago. Each operator should be required to demonstrate its ability to procure and to install the hardware and to train its pilots in the operation of TCAS prior to this evaluation.

2. The major thrust of the evaluation should focus on a mix of aircraft in busy terminal areas. This is where the interaction between both the ATC system and aircraft Mode S coordination will be the greatest. However, the evaluation will not be complete unless a representative number of domestic wide-body, narrow-body and 30-to-60 passenger regional aircraft are equipped and exposed to conditions in both en route and terminal airspace.

3. There should be no level-off of TCAS installations during the evaluation. While an identified "critical mass" of aircraft are required initially to measure TCAS impact, if that same number is maintained until the end of the evaluation, all that will be known is that the system can accommodate that particular number. A more effective evaluation would be one that began with a specific number and increased pressure on the system through a continuous increase in aircraft equipage. Only by doing this can you insure the system will, in fact, be able to accommodate the number of TCAS equipped aircraft that will eventually be operating in our national airspace system. We further question if it is either operationally or economically beneficial for operators to interrupt the installation process once it has begun.

4. We feel a six-month evaluation should be adequate if no significant problems are identified since input on system operation will begin early in the equipage program. The administrative costs of any program longer than a six-month program may also be difficult to justify given that we have completed limited evaluations at three separate airlines.

5. An industry working group should be established to define exactly what is required to answer the operational questions relating to both the airside and ground-based ATC system concerns. It does not appear the ground-based phase of the evaluation has received the attention it requires. In our opinion, this element of the program is equal to the concerns over airborne system performance and operational procedures. Means to collect and analyze data from ATC facilities and controllers must be identified and then made an integral part of the OTA evaluation program.

In addition to the issues relating to an evaluation period I have noted above, there are two additional items I would like to bring to your attention that could affect the timeliness and quality of the evaluation. The first is TCAS system certification for each operator by the FAA. The initial requirement for this could be the bottleneck for the entire program. We understand the number of people the FAA now has to perform this task is totally inadequate. If you ask any of the TCAS manufacturers what they believe to be the biggest stumbling block in the implementation program, I am sure they will respond "the certification process." We believe that unless this problem is addressed head-on by the FAA, and unless more resources are committed to the certification

workload, any implementation schedule may be purely academic.

The second item is funding for sixty airborne recorders to be used in the evaluation. It is our understanding that while the FAA has been authorized to procure this equipment, no funding has been allocated for it. Therefore, another unanticipated glitch could occur. Hopefully, this shortfall can be quickly resolved and equipment procurement can begin.

The third major concern we have relates to the progress of TCAS III. As you know, Mr. Chairman, we still firmly believe TCAS II is only an interim system and that the operational flexibility provided by TCAS III is essential if the traveling public is to receive the maximum degree of protection TCAS is capable of providing.

For example, TCAS III has more accurate bearing information than does TCAS II. Several advantages arise from this. The first is that a more accurate threat assessment can be made and a lower unnecessary alert rate results. This will greatly improve pilot confidence in TCAS and dramatically diminish the potential for any secondary encounters the controllers may have to manage. The second advantage is that TCAS III can recommend a horizontal

resolution maneuver. This again would instill pilot confidence since the TCAS III logic contains some "pilot preference" rules as tie-breakers for resolution plane selection. Thus, TCAS may well choose the same maneuver the pilot would choose if he had visual acquisition of the intruder. And lastly, since normal ATC horizontal separation standards are much larger than vertical standards (e.g., 18:1), a horizontal displacement by an aircraft executing a horizontal resolution maneuver is much less threatening to the ATC system than one in the vertical plane. The absence of this horizontal resolution capability in TCAS II has required the FAA to contemplate revisions to the vertical escape maneuvers that are totally inconsistent with pilot reactions and highly questionable from an aircraft performance standpoint. While such maneuvers may only be required in certain situations, they nevertheless dramatize the need for simple left or right turns.

One particular item relating to TCAS III we question is contained on page 7 of the January 1989 TCAS Report of the Secretary of Transportation to Congress required under Public Law 96-193. This particular item relating to the TCAS III program shows over a year lapse from the time the TCAS III MOPS is drafted until beginning a TCAS III Limited Installation Program in 1991. We

believe that in view of the past and ongoing testing of TCAS III by the FAA Technical Center, this period of time is excessive and should not be permitted. Hopefully, you will have the opportunity to ask the FAA to justify this delay.

In summary, Mr. Chairman, we believe that TCAS equipment should be installed as soon as certified and available, that the air carriers be required to participate in an operational evaluation program in a timely manner with a sufficient percent of their fleets to insure valid results, and that you should discuss TCAS III milestones with the FAA to insure that system receives the attention needed to reach completion and installation in the air carrier fleet.

Thank you for the opportunity to comment on this subject, and we would be most pleased to answer any questions you may have.

Mr. OBERSTAR. Our next witness, the long-suffering, redoubtable Mr. Broderick, who is what they call an all-purpose back in football. [Laughter.]

It seems every time there is a hot issue involving the FAA, I see the nameplate of Mr. Broderick in front of me.

We welcome your presence. I want to say for myself and for Mr. Clinger, we greatly respect your professionalism.

TESTIMONY OF ANTHONY BRODERICK, ASSOCIATE ADMINISTRATOR FOR REGULATION AND CERTIFICATION, FEDERAL AVIATION ADMINISTRATION, ACCOMPANIED BY TOM McSWEENY, DEPUTY DIRECTOR, AIRCRAFT CERTIFICATION SERVICE, FEDERAL AVIATION ADMINISTRATION

Mr. BRODERICK. Mr. Chairman, thank you very much.

If I may, I would like my full statement to be entered into the record and give some brief summary remarks.

Mr. OBERSTAR. Without objection, so ordered. And please feel free to address any of the other loose issues that were raised as we went through the previous questions and answers.

And would you at this time introduce your associate?

Mr. BRODERICK. Of course. Mr. Chairman and members of the subcommittee, with me today is Tom McSweeny, Deputy Director of the FAA's Aircraft Certification Service.

We are pleased to be able to talk with you today about progress in an exciting new piece of equipment which we believe will contribute greatly to enhanced aviation safety.

TCAS is a development in which we all should take pride. Though it has been literally decades in the development stages, electronic collision avoidance equipment is not something that has been anywhere but at the top of our priority list. It is only recently that we have developed the computer software and hardware technology to bring our concepts and designs into reality.

Our recently completed cooperative limited installation programs conducted under contract with United, Northwest, and Piedmont Airlines in cooperation with Bendix/King and Sperry/Dalmo-Victor, proved that these systems could be designed, built, and successfully operated in the demanding real-world environment of commercial aviation.

I have provided the subcommittee staff with some of the commercial literature which describes the TCAS units presently being offered, along with a short videotape describing the operation of TCAS.

We have a number of challenges that remain before us, but we can say with a great deal of confidence that airline passengers will in the coming months begin to enjoy a margin of safety from midair collisions that has in the past only been a hope.

The OTA study discussed earlier today is one which I am pleased to acknowledge is a real contribution to our TCAS efforts. Their review of a number of technical, economic, legal, and international issues which were not readily apparent when the original TCAS statute was enacted provided an excellent platform from which to review our progress to date. And they made a number of construc-

tive suggestions to help us ensure that implementation of TCAS goes smoothly.

Congressman Packard's bill, H.R. 2151, is a proposal which we welcome. Building upon an analysis of our progress to date and the results of the OTA study, this legislation also recognizes the desirability of establishing a phased TCAS implementation schedule whose milestones could be harmonized with those required for the installation of recently mandated windshear avoidance and flight path guidance equipment.

I hope these hearings will help speed that legislation through the Congress so that we can put the necessary program adjustments promptly into place.

Mr. Chairman, Tom and I welcome the opportunity to respond to your questions at this time.

Mr. OBERSTAR. How long a delay period do you think is necessary?

Mr. BRODERICK. I, like others before you, would like to see no delay. If a delay is necessary, I would like to see the shortest possible delay. But I have got to recognize that only one group of witnesses provided data which substantiates the need for any delay at all, and that is the airlines, the Air Transport Association.

I have heard nothing from any of the preceding witnesses, and I have no data myself to disagree with their assessment that two years is necessary.

Mr. Chairman, let me briefly talk about the problem that we are faced with and divide it into a couple of phases.

The first thing that we could talk about is do we have a problem with the availability of the TCAS hardware. I think the answer to that is no. We could have all the TCAS hardware you need from Bendix, Sperry, Collins, and others within a 2-year period.

The question really is can we backfit 4,000 aircraft with the wiring, the antennas, and the other installations and then do the necessary testing to ensure that backfitting has been done properly in a period of time.

Mr. OBERSTAR. That technology question is key, and the question of operation within the TCA, I think, is key.

Mr. BRODERICK. Well, that's right.

Mr. OBERSTAR. Address those two issues.

Mr. BRODERICK. I would like to talk about that separately.

Mr. OBERSTAR. Take your time.

Mr. BRODERICK. Let me ask Tom McSweeny to give you a feel for what we are demanding of the airlines over the next 5 years. Some of these things he will talk about are not yet on the books, but it will give you an appreciation for what it means when I say that over the last 18 months we have been issuing regulations or proposed regulations at the rate of three a month in the safety arena. In addition, we issue almost every day an airworthiness directive which mandates a design change.

Tom?

Mr. MCSWEENY. First and foremost, I think, is the aging-aircraft issue. I think everybody is aware of the significance that we placed on that. It is the number one priority within the agency.

I recently looked at the three airworthiness directives that will be addressing the 727, 737, and 747 for issuance as proposals. And

they talk about 17,000 work-hours per airplane to accomplish simply the aging-aircraft modifications that we are going to propose. We are talking close to $1 million an airplane. Certainly, we are talking about airplanes that are old, not airplanes that are brand-new.

We are also finishing up action on a seat retrofit rule that is very significant and very important. We learned a lot from some of the seats that were involved in an accident recently over in England, the new 16-G seats. So, we are moving on that. That is going to be very significant.

We are also addressing all cargo and combi airplanes because we feel that there have been some recent events that cause us to think that maybe we need to do something about putting automatic fire extinguishers in those airplanes where there are none right now.

We are looking at cargo compartments liners being mandated. The rule is out. They have to begin to be retrofited. And certainly last but not least we have got—well, one, two more: we have got interior materials, which will trigger again in 1990, and when you make a mod, you now will have to meet, if you refurbish the entire airplane, you will have to meet the new 65 standards.

And then lastly, as Mr. Broderick mentioned, we have got windshear.

Those are the ones we know of at this point.

Mr. OBERSTAR. I meant to ask the ATA panel, and it slipped my mind. The cost of windshear detection system for aircraft, do you have that kind of information?

Mr. BRODERICK. Well, it's quite a bit less than TCAS. I would put it at something in the $200-400 million range for the total fleet. Something like that.

Mr. OBERSTAR. A number of modifications, a number of--and it was very helpful to have that listing, and I appreciate your providing it for the committee, including aging-aircraft issue, and that is going to be a continually evolving process.

So that there is going to be a good deal of stress on maintenance bases to do all those modifications.

Mr. BRODERICK. Mr. Chairman, there clearly is——

Mr. OBERSTAR. The assessment is, though, that no etheless they have the capability to undertake this work and to do it.

Mr. BRODERICK. That is correct. We have to look at two things. We have to look at the structural work and the electronics work and the electronic technicians.

I think that when you really break everything down, the fundamental limit that the industry sees with regard to the TCAS retrofit, the wiring problem, is the limitation on people. I think that probably somehow, some way, one could find the dock space. It wouldn't be easy, but most of this work is relatively undemanding on docks. That is not the biggest problem.

I think the biggest problem that was brought out by ATA is the availability of skilled and trained personnel in the United States to do the work. And I frankly have nothing to question their estimate of a 4-year period. Certainly it's somewhere between 3 and 4 years or a 1 to 2-year extension on the current regulation. That appears to be reasonable.

Let me add a couple of other comments to that. There has been quite a bit of discussion in the hearing this afternoon about the possibility of making a decision to extend the compliance date by 1 year but then writing into the law some flexibility so that if during the operational test and evaluation phase some problems developed, one could extend still further the deadline perhaps up to another year.

I think we have mixed apples and oranges in that discussion. And let me say why. What we need, what Mr. Clinger talked about earlier today, what Mr. Packard has talked about, I think, as well as yourself, is we need a decision to set from now until either the end of 1992 or the end of 1993 a retrofit schedule for wiring in aircraft. That is the question of whether it's a 1-year extension or a 2-year extension. That decision has to be made today.

If you make a decision today that it is going to be a 1-year extension, then with acts of God and things like that out of consideration, people are going to somehow figure out a way to either meet that or be unable to meet it.

But there isn't going to be a question of waiting three years or 2½ years and deciding on whether or not we have had an operational test and evaluation problem. It's a question of wiring, not operational test and evaluation.

H.R. 2151 deals with the operational test and evaluation issue and the findings in a different way. It acknowledges implicitly the possibility that during the test phase we will find problems, and it permits the Administrator by regulation to extend the 50 percent compliance milestone by up to a year—in other words, hold the 25 percent compliance milestone steady for a year—so that the changes can be made, the changes to the equipment that is already installed, and you won't be penalized by installing new equipment which obviously, by the determination that we have hypothesized here, is not working.

So, Mr. Packard's bill recognizes the operational test difficulties which might arise and takes care of those within its framework. That is not relevant to the question of deciding today when 100-percent compliance is going to be achieved. That is the decision that the committee needs to make.

And I think you asked an earlier question of one of the witnesses as to what the quantitative effect would be on safety. Let's assume that the 3-year program or the 1-year time extension is a 100 percent effective program; that is, I am saying it buys 100 percent of the safety benefit of TCAS because it's the best possible thing that you could do.

Relaxing by 1 year the 100 percent compliance date gives you an 88-percent effective program, roughly a 90 percent gain, because you have already installed the majority of the TCAS equipment. That is assuming, of course, 25 percent, 50 percent, 75 percent, and 100 percent uniform milestones.

So, I think it is not a question of whether or not TCAS is to be nor whether or not TCAS is to be installed by 1991 or 1992 in a large fraction of aircraft, it's whether or not that last 25 percent is going to be installed by 1992 or by 1993. That is really the question, and it is something that has got to be answered quite soon or the

answer becomes something that can affect the aircraft planners. And that would be a big problem.

Mr. OBERSTAR. The legislative process doesn't move always as quickly as we would like, since we have two bodies to move these bills through, and then the White House for signature, and then you folks and finally OMB for rulemaking and all that process.

How soon is soon?

Mr. BRODERICK. This summer. This summer is certainly, I think, a reasonable time to look at. Clearly that is not good news from many viewpoints, but I wouldn't consider from a realistic and practical viewpoint the need to write regulations on our part, although of course that need exists.

The fact is that once the Congress sends a clear signal that a 2-year extension or a 1-year extension, as you deem appropriate, is going to be made, we will have no practical alternative but to issue the regulation. And while it will take several months for us to do that, I have no doubt that we will do it in accordance with the statute.

Mr. PACKARD. Would the Chairman yield on that, please?

Mr. OBERSTAR. Yes, I would be happy to yield to the gentleman.

Mr. PACKARD. I am convinced if this committee knew that there was going to be a midair collision on June 15, we would have this legislation through and enacted into law in order to—well, that date would not be thwarted by this law.

But if there was that kind of urgency, we could certainly fast-track this through. I am sure that this would carry on suspension, I am sure that it would be a fast markup in subcommittee and full committee markup, and I am convinced that I could persuade the Senate to move it quickly, and the President would have very little reason to languish over it.

I believe that we could move it rather quickly. I would hope so.

Mr. OBERSTAR. I share that optimism, but optimism has so often foundered on the rocks of the filibuster in the Senate that I don't know.

[Discussion off the record.]

Mr. OBERSTAR. Let me at this point yield to the gentleman from California.

Mr. PACKARD. Thank you, Mr. Chairman.

Only a couple of questions. Again, there are many that could be asked, but I think you have well discussed them in your presentation, Mr. Broderick.

You are indicating in your testimony that there is no reason whatsoever in your view to be concerned about whether FAA can meet their deadlines that allows the manufacturers and the airlines to move forward in starting this whole process. Certification and all that needs to be done by FAA that is in the current law, you can meet that schedule?

Mr. MCSWEENY. Let me respond to that. The answer is yes. We have begun already, in fact months ago, preparing for that eventuality. We have set up specific teams, specific emphasis. We have held meetings with our people to train our people in the various offices. We have a standing team to review all the programs, and we have given it a very, very top-management commitment that

we will do everything possible to ensure that there are no problems.

We are also training the industry. We are talking to other airworthiness authorities.

So, we had begun well before the first production unit is out of the shop.

Mr. PACKARD. Thank you.

The FAA met with the European people recently, and I would be interested in your evaluation of their attitude on TCAS itself, the requirement, in other words, that we were placing upon the foreign carriers as well as the standards, the schedule, et cetera.

Could you elaborate and enlighten us on your observations with the Europeans?

Mr. BRODERICK. Broadly speaking, the Europeans—in fact let me say other countries in general—have expressed consternation at the unilateral action of the United States. The extraterritorial reach of this legislation and our regulations is something that doesn't sit well because of the Chicago Convention and their view of how we as individual nations should behave with regard to aircraft modifications required for flight into one another's countries.

But be that as it may, we have an excellent working relationship on the technical level with all of the airworthiness authorities involved. Tom's folks have worked closely giving seminars with them because after all they have counterparts to me and counterparts to you in each country. They have to approve and certify the modifications to their nation's aircraft.

The ICAO, International Civil Aviation Organization, working groups which are charged with coming up with standards and recommended practices, the international standards that were referred to earlier, for TCAS, or collision avoidance equipment, are working well. They will work at a somewhat slower pace than we do because of the many nations involved. But nevertheless, we expect, I think, by sometime in 1990 for them to develop standards. And I think that the legislation that you have written recognizes again implicitly the difficulties of being so far away, not being involved in the day-to-day development of this, and provides a little bit more flexibility to foreign airlines than the present regulations allow.

Mr. PACKARD. I think you rightly express the thought that the real difficulty that we struggle with in meeting the current law's schedule or any schedule is the number of certified, experienced, qualified technicians to actually do the retrofitting.

If there is a shortage in this country and thus they have to look to foreign shores, in order for foreign carriers to meet the retrofitting schedule of either the one or the two year, would they be looking to the United States contractors or would they have a surplus of contractors that our carriers would be able to look to foreign contractors as a kind of a spillover for shortages here?

Mr. BRODERICK. Our experience shows that the United States enjoys a very great advantage in the balance of business, as it were, in aircraft maintenance. That is to say that for every dollar that is spent overseas by the large U.S. carriers, about two dollars is spent in the United States by foreign carriers.

There is not a great pool of qualified radio and electronics people overseas which the U.S. airlines could draw upon. It would be my expectation that much of the TCAS business with regard to retrofit would in fact be done in the United States.

Mr. PACKARD. Would you expect—may I interrupt—would you expect that foreign carriers would look to the United States for some help in this area of meeting deadlines more than the domestic carriers would look to foreign contractors?

Mr. BRODERICK. Based on our past experience, I would expect by an overwhelming amount that that would be the case.

Mr. PACKARD. That is interesting.

The last question I have, Mr. Chairman.

Windshear, one of the objectives of the legislation pending is to tie windshear retrofitting with TCAS, which was a recommendation of the OTA study and it is certainly a recommendation of the airlines themselves. Everyone, I think, agrees that that is a reasonable and a wise approach.

Do you see any effects of that effort, trying to tie the two processes of equipping together, affected by the delay, whether it be 1 year or 2 years? Do you see that there are problems under a year's delay versus a 2-year delay?

Mr. BRODERICK. There are no conceptual or technical problems. The only issue is to draft the regulation. But as I indicated earlier, once the legislative decisions are made by the Congress, the regulatory language will effectively have been telegraphed, and so people won't have to wait for a regulation because our regulation will merely implement the statute that is passed and signed by the President.

Mr. PACKARD. So, windshear equipment will come off the supply lines head off or at least equal to the manufacturing of TCAS?

Mr. BRODERICK. Yes. There is no difficulty with regard to the availability of windshear equipment.

Mr. PACKARD. Thank you, Mr. Chairman.

Mr. OBERSTAR. All right.

Given the number of other actions, modifications to aircraft that Mr. McSweeny cited—the flight data recorders, windshear detection, aging-aircraft adjustments, other advisories that have been sent out—plus now the TCAS—do you feel that the carriers can comply with the deadlines that are now in law?

Mr. BRODERICK. Including the TCAS deadline?

Mr. OBERSTAR. Including the TCAS deadline, yes.

Mr. BRODERICK. No, I don't. I think we have—all the evidence that we have tells us that the present TCAS regulatory requirement cannot be met by the U.S. carriers.

Mr. OBERSTAR. For two purposes that you addressed earlier: retrofit schedule and operational questions?

Mr. BRODERICK. The operational questions really are over and beyond the question of whether or not the airplanes can actually be fitted with TCAS equipment and comply with the regulations. That adds yet another dimension.

What I am focusing on, Mr. Chairman, is literally the ability of the airlines to wire the aircraft and plug in the equipment which we know is available. It's the wiring of the aircraft and the installation of the antennas that is the real problem.

Mr. OBERSTAR. All right. Then since we have to address that issue by legislation if we are going to do something to assure that the benefit is achieved and it's done in an orderly fashion, how much should be addressed in statutory language and how much of the time frame should be given to administrative discretion?

Mr. BRODERICK. The——

Mr. OBERSTAR. Well, let me give you a moment to think about that while I say something else.

Given my druthers, I would not have tied the legislative knot around this issue. I would have preferred that FAA issue regulations and that the Congress oversee the implementation of those regulations, keeping feet to the fire but not having to come back and relegislate.

However, we do have the law in place. So, now let us be careful about what we do in adjusting that law.

Mr. BRODERICK. Well, that is exactly right. The fact that we have the law in place is what is causing us to be here today. That coupled of course with the statement I made earlier that it is my belief and the belief of at least—well, I think all of the witnesses here—that the present deadline is not achievable, we are required to make some change.

As I indicated earlier, it appears that somewhere between a 1-year and a 2-year extension is what is called for. What is desirable is the shortest possible time. But one doesn't want to be having another one of these hearings in a year or 18 months saying, gee, 1 year wasn't enough.

More important, perhaps, though, is what is going to happen once that decision is made in the next couple of months. What is going to happen is a schedule is going to be laid out at every airline and every repair station for retrofitting, wiring, and antenna installations in 4,000 aircraft. And the question is whether the schedule will be laid out over a 3-year period to 1992, or over a 4-year period to 1993?

I think that it is unreasonable to effectively postpone that choice for another couple of years until after the operational test and evaluation program is in place, because what is going to happen is that people who tried and succeeded in obeying the law will be punished by anyone who succeeds in getting an exemption or a delay in the law two years from now.

So, we really need as a matter of equity to make that decision as soon as possible, and I don't see any realistic way—being in the situation where we are faced with a statute that we know needs changing—of now trying to split between statutory and executive discretion.

That decision, it seems to me, was made a couple of years ago when a statutory decision was made to mandate a given installation schedule, and now we are faced with having to amend that and amend it in a way that will be the last time we have to amend it.

Mr. OBERSTAR. Let us marshall the wisdom of Solomon toward that purpose and think constructively and collectively in achieving that purpose.

Did the gentleman have further comment?

Mr. PACKARD. Yes. Before you wrap up, I would like to follow up with your questioning and some of the comments.

One of the concerns, I think, is that those large airlines that have the inhouse capability to retrofit and the expertise to retrofit their fleet are often called upon to contract and contracted for to do some of the smaller airlines that have no inhouse capability.

What kind of problems will that create as we move toward a rather difficult deadline in terms of scheduling for the smaller airlines? Obviously, the larger ones will take care of their own first to meet deadlines and not be penalized, and the smaller ones may find it difficult to find a contractor out there that they can rely on.

Mr. BRODERICK. That is exactly correct. That is exactly what I would expect to happen. The larger airlines, because of their resources, will effectively de facto force the smaller ones away from their normal source of supply for this kind of work.

Mr. PACKARD. So, in looking for a suitable deadline, perhaps we ought to look at that segment of the industry more than we would the larger carriers?

Mr. BRODERICK. That's right. In a very odd way, what we have is a system which—or a situation, rather—which presents a problem to the very largest airlines who need to have time to retrofit their very large fleets of aircraft.

If we push those very large airlines to do it in the shortest conceivable time, they may be able to, but for sure the smaller airlines are going to have a big problem.

So, it is a very unusual twist and something that doesn't often happen. In fact, I don't know when it has ever happened before except perhaps in something as the Chairman mentioned earlier: the ground proximity warning system or the ELT.

Mr. PACKARD. One last question, Mr. Chairman.

During the LIP program, pilots, the test pilots, were given immunity from violations, et cetera. During the evaluation phase and during the implementation phase, what kind of policy will FAA take in terms of either continuing those immunities, or how will they deal with those conflicts that the pilots run into with the use of the TCAS system versus ground control and a variety of other informational systems?

Mr. BRODERICK. The reason we gave immunity, if you will, to the pilots in the test program was because it was an unknown situation both to them and to us and we wanted to have them be able to participate with a reasonable degree of assurance that it wouldn't affect their livelihood.

We want that to continue, not only in the operational testing phase over the next few years but when TCAS comes into full-scale operation.

I don't think immunity is the right term to use in that case, however, because we will both have learned how to deal with this question, and whether we need written policy guidance or written statements of policy that the pilots, the controllers, and FAA management can all agree on or whatever, it will probably take a different form.

I don't think that I like to use the term immunity, but clearly we all have to work together with the same goal in mind, which is safe air transportation.

Mr. OBERSTAR. That latter one is a very good one, very, very important for us in the sense that it hasn't been raised earlier, and surprisingly not by the pilot groups. A very important question to raise.

Are staffing levels in place to conduct the TCAS certification?

Mr. MCSWEENY. Yes.

Mr. OBERSTAR. Or are they inadequate, as ALPA alleged?

Mr. MCSWEENY. Well, we don't agree with that. They certainly are there, they are available. We are a discretionary function. We use a lot of DER's in the approval of the systems. Some of the companies that will be doing the installations have designated alteration stations which are delegations. And so we have the ability to take our resources and spread them out over a much larger area by picking and choosing the things that are really important.

First-of-a-kind STC's are going to get a lot of scrutiny. Second, third, fourth, twentieth are going to not get the same because you're making minor changes to an already existing approval system.

We are not saying we are not going to see some problems as we go along, but we are trying to get the management chain together, to be aware of them, to focus on them, to make sure that we don't cause anybody missing the TCAS schedule.

Mr. OBERSTAR. OK.

The OTA suggested that FAA would need contract support beginning later this year to undertake all this additional work. I would like your response to that point. I am sure you are aware of their comment in the report.

Mr. BRODERICK. Yes, I am. And we will use contract support. We have in the past been assisted in the TCAS program by a number of contractors, MITRE and Lincoln Labs being very prominent among them.

We expect to spend over the next couple of years on this program about $4 million. And some of that is actually a line item in our 1991 budget.

We are going to work with the appropriate committees of the Congress to make sure that appropriate report language is included in our appropriations bill for 1990, so that we can get an early start on the necessary hardware procurements for the operational test program right after the first of the fiscal year.

But we are aware of the need for that. We will expect to work with the appropriations committees and secure the reprogramming authority to carry this program out in a timely fashion.

Mr. OBERSTAR. Well, this committee will certainly support those efforts. I know we will get a bipartisan effort to assure that the FAA has the resources in money and people to do the job of implementing the TCAS program.

Will high-wing and turboprop aircraft be evaluated sufficiently during the proposed 1-year evaluation period?

Mr. BRODERICK. I think so. We are actually working right now with a turboprop. In fact, it's a high-wing turboprop aircraft. And we intend to work with all of the airlines that have over 30 aircraft in this program.

Mr. OBERSTAR. That is good to hear.

Harkening back to testimony over a year, two years ago maybe, my recollection is that you told the I&O subcommittee that TCAS III would, if fully installed, 100-percent installation, would result in one midair collision in 400 years.

Mr. BRODERICK. I might have made such a calculation. I don't remember the numbers, but I do remember a discussion with the Chairman at that time that the TCAS III can be calculated to be a more effective system than TCAS II. And I think the difference was something like what you have implied. But as you stated earlier today, the perfect should not become the enemy of the good, and TCAS II is a very good system.

Mr. PACKARD. Would the Chairman yield on that?

Mr. OBERSTAR. Yes, I would be happy to yield.

Mr. PACKARD. I remember also when we were having our hearings in the subcommittee on the initial legislation, I asked the question of the FAA at the time how many midair collisions in the last ten years would have been avoided had TCAS II been on board.

And the statement was—and I don't know under what circumstances he verified it—but it was 100 percent of them.

And my comment at that time was 100 percent is good enough with me and let's go ahead with TCAS II.

And I still believe that we made the right decision.

Mr. OBERSTAR. Very good.

I don't have any further questions. I do want to say that the committee will act expeditiously. We want to devise a formula that will carry the agency, the carriers, the pilots, the mechanics, the avionics people into this program without delay and without necessity to relegislate this issue.

That is a big challenge, to try to write into law something that doesn't need to be legislated once again. Let's all bend every best effort toward that purpose, and the bill of the gentleman from California is a good starting point, and we will work around that.

Mr. BRODERICK. Mr. Chairman, we will be very happy to help you, and any data we can provide we will be happy to do so.

I would like just to make a closing comment that we have heard from a number of witnesses today, myself included, that we have certain desires, certain wishes, and among those wishes is that TCAS be installed as soon as possible and perhaps, hopefully, with only a one-year delay.

On the other hand, we have heard from one set of witnesses some hard data, some numbers. And when you weigh those two things, it seems to me that we have got to look very closely at the hard data when we are setting hard dates by which we must comply.

Mr. OBERSTAR. That is quite correct. Let us try to find the proper mix of flexibility on the part of the agency to adjust to unforeseen changes and the shortest possible time frame within which to assure that this life-saving technology is installed for the benefit of the air-traveling public.

Thank you.

[The prepared statement of Mr. Broderick follows:]

STATEMENT OF ANTHONY J. BRODERICK, ASSOCIATE ADMINISTRATOR FOR REGULATION AND CERTIFICATION, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, SUBCOMMITTEE ON AVIATION, CONCERNING THE TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM. MAY 4, 1989.

Mr. Chairman and Members of the Subcommittee:

I am pleased to appear before you today to discuss our efforts to comply with the statutory requirements for the implementation of the Traffic Alert and Collision Avoidance System (TCAS). We appreciate the support and guidance which this Subcommittee has given to our efforts to develop TCAS and look forward to your continued support to reach our shared goal of minimizing the possibility of midair collisions.

Nearly eight years ago, the FAA decided to proceed with the implementation of TCAS. Since that time, the FAA and the aviation industry have made great strides in overcoming this most complex and difficult technological challenge. I would like to briefly review for you our approach to TCAS.

We have attempted to develop a family of collision avoidance systems, demonstrate the operational and technical feasibility of the concept, and support the development of national and international standards for the equipment.

As you know, there are three versions of TCAS: TCAS I, TCAS II, and TCAS III. The least expensive system, TCAS I, is designed for use on smaller turbine-powered aircraft with seating capacity of

30 seats or less. TCAS I will only generate traffic advisories. Traffic advisories indicate the presence of other aircraft. Because of its estimated cost of approximately $10,000, it should be affordable for installation on some general aviation aircraft.

TCAS II will generate traffic and resolution advisories. Resolution advisories tell the pilot what maneuver to execute to avoid another aircraft. In the case of TCAS II, only "up or down" advisory maneuvers are provided. TCAS II is intended for installation in medium and large transport category type aircraft.

TCAS III is also intended for installation in transport category aircraft. This advanced system, when fully developed and certified, will generate traffic and resolution advisories in both the horizontal (right or left) and vertical (up or down) planes. Our work with TCAS III is structured into two distinct program stages. The first is a formal development and validation phase during which the required technical characteristics will be determined, the technical issues identified, and the technical performance verified. Once basic system performance has been demonstrated, a limited installation program will be implemented. TCAS III is still in the first phase of development and is undergoing further testing. It will not be ready for FAA certification for some time.

The Airway Safety and Capacity Expansion Act of 1987, enacted on December 30, 1987 as Public Law 100-223, required that all air carriers be equipped with TCAS II by December 30, 1991. I would now like to provide an overview of our initiatives to comply with the statutory mandate.

An operational evaluation of a TCAS II prototype system was conducted last year on a Piedmont Airlines B-727. This operational evaluation was designed to provide initial crew reaction to TCAS II generated traffic and resolution advisories. We believe the evaluation was successful and demonstrated that flightcrews are able to use the system properly without being distracted.

Utilizing cost-sharing contracts, the FAA provided seed money to Allied Bendix Corporation teamed with United Airlines, and to Honeywell Corporation teamed with Northwest Airlines for linited installation programs (LIP). A total of 14 preproduction units were fabricated for demonstration during the LIP evaluations. The LIP programs began in January 1988, with units installed on United Airlines B-737 and DC-8 aircraft. Northwest Airlines is currently flying two MD-80's with TCAS II units. Results of the LIP flights to date indicate that TCAS II provides a significant degree of protection against potential midair collisions, has little or no impact on the air traffic control system, and has little or no

impact on pilot workload. With the LIP well underway, and manufacturers initiating production units for both national and international airlines, the development of TCAS II is completed. In fact, TCAS units will be included in the new aircraft being ordered by air carriers to replace their aging fleet.

In February of this year, our Final Rule requiring TCAS installation no later than December 30, 1991 became effective. Our Final Rule is responsive to the requirements of Public Law 100-223. In October 1988, the FAA published Technical Standard Order (TSO) No. C-119, "TCAS-II Airborne Equipment." This TSO provides the performance standard that TCAS devices must meet in order to be acceptable to the FAA. In addition, Advisory Circular (AC) 20-131, "Airworthiness and Operational Approval of Traffic Alert and Collision Avoidance System (TCAS II) and Mode S Transponders," was published. This AC provides guidance material for those interested in obtaining airworthiness and operational approval of TCAS. In conjunction with our regulatory requirement, these materials provide all the necessary documentation to support certification of TCAS II.

The FAA has also established a training workshop for its engineers and flight test pilots who will be involved in TCAS certification,in order that we can consistently interpret certification criteria resulting from questions which inevitably

arise from such technical projects. We anticipate making this training available to the private sector to assist in its implementation of TCAS systems.

To facilitate the smooth certification and installation of TCAS II, we have established a TCAS certification project office. In addition to being responsive to questions and problems from local aircraft certification offices (ACO), the certification project office is also the focal point for a special certification team, which will be available to the ACO's for technical guidance and assistance. We are currently in the process of establishing a transition team to help provide for an orderly transition from initial installation to complete airline TCAS II-equipage. The team will support the airlines and avionics industry during initial implementation and will assess TCAS system operability in the National Airspace System.

We have also conducted a number of workshops in the United States and one in Europe to provide detailed information to airworthiness officials and industry representatives. Another European workshop is scheduled for this summer. We are also attempting to schedule a workshop for South American carriers and civil aviation authorities. These workshops were designed to make clear that all affected parties understand the TCAS requirements and the projected compliance schedule. These workshops are important in

that they assist all affected parties in developing acceptable airworthiness compliance standards. As recently as last week, we met with the Air Transport Association to discuss details of TCAS implementation and a monitoring program to assure a smooth introduction of TCAS into the National Airspace System.

Subsequent to the passage of Public Law 100-223, the Senate Subcommittee on Aviation asked the Office of Technology Assessment (OTA) to assess the safety implications of the TCAS II certification and implementation schedule. The OTA study, completed in February, reviewed a number of safety, technical, economic, and international issues, which were not readily apparent at the time of the law's enactment. The study concluded in part:

> "Although OTA finds no reason to delay initial TCAS II implementation, sufficient airline resource limitations, economic inequities, and international implications stem from the present deadline for Congress to consider extending the installation schedule. If an extension is enacted, specific requirements in the same law will be needed to ensure that installation of TCAS II begins promptly after production equipment is available and proceeds at a reasonable pace over the span of any extension. Prompt congressional consideration of any change to Public Law 100-223 is also important. Indeed,

the forcing effect of legislation is likely to be necessary to ensure maximum safety benefits as early as possible and to allow airlines to make appropriate plans for investments in personnel and equipment."

The OTA further noted that requiring and linking an operational evaluation program, a phased compliance schedule, and an extended deadline would place additional responsibilities on each affected party and spread economic burdens more equitably, while providing maximum safety benefits.

Members of Congress and others have written the FAA to determine our views on a TCAS phase-in period. We agree with the establishment of a phase-in of TCAS. During a phase-in period safe system design can be verified, operational reliability can be demonstrated in actual service, and any unexpected air traffic control system interactions can be analyzed. Our experience with the ground proximity warning system and the emergency locator transmitter showed that undue haste in requiring the installation of new systems led to a great deal of confusion, frustration, and unnecessary cost. As I indicated earlier in my testimony, TCAS is one of the most tested pieces of avionics ever developed. Over 2,000 hours of actual flying were done with the Piedmont and United Airlines, and the Northwest effort is virtually completed.

TCAS is a well-proven system in which we have great confidence. Nevertheless, it is a virtual certainty that small unforeseen difficulties will arise when large numbers of aircraft are equipped with and using TCAS. Were it not for the tight statutory TCAS installation deadline, we would propose to provide for such a phase-in period by regulation.

As you know, Mr. Chairman, we have another regulatory initiative requiring the installation of windshear alert and flightpath guidance equipment. We believe that it would be more efficient and substantially less costly if there were congruence between the installation timetables for TCAS II and the windshear alert and flightpath guidance equipment. Our original proposal for installation of windshear equipment was two years. However, following that proposal, Congress enacted Public Law 100-223, which set a firm December 30, 1991, deadline for TCAS installation. We concluded that it would not be possible to meet both the two-year windshear equipment installation schedule and the statutory mandate for the installation of TCAS. In view of the conflict and recognizing our inability to extend the TCAS installation date through rulemaking, we amended our windshear rule installation period for those air carriers which can demonstrate a need for an extension.

Today, with the benefit of more knowledge and experience in both

the TCAS and windshear equipment installation, it is clear that even the existing windshear equipment installation schedule deadline is going to be difficult to achieve by some air carriers, though we continue to believe that schedule can be met. There is no doubt, however, that it would be far more efficient to have the two installations schedules identical so that significant aircraft alterations can be dealt with at one time.

These are extremely complex avionics retrofit installations which are on a very tight timetable. Their complexity means that literal disassembly, modification, and reassembly of major portions of the cockpit and electronics bays will have to be undertaken for all aircraft. The lack of commonality of the schedules means that, practically speaking, in order to meet the tightest TCAS schedule, no advantage can be taken of the opportunity to install windshear equipment when TCAS is being installed. To do so would slow down TCAS installation and endanger compliance with the statutory deadline. We believe it would be preferable to have one cycle of disassembly and reassembly during which both systems are installed. Any decisions requiring an adjustment in the TCAS schedule should be made as soon as possible to avoid chaotic, uneven or potentially unfair effects on the various air carriers. The establishment of a phased compliance schedule, with identical milestones for each

program, would be desirable and, for this reason, we support the recently introduced proposal to make necessary schedule changes.

In closing, I would like to again stress that we appreciate the Subcommittee's interest in the development of TCAS to improve aviation safety. Mr. Chairman, that concludes my prepared statement and I would be pleased to answer any questions you or other Members of the Subcommittee may have.

Mr. OBERSTAR. The subcommittee stands adjourned.
[Whereupon, at 6:46 p.m., the Subcommittee adjourned.]

ADDITIONS TO THE RECORD

7612 Alverstone Avenue
Los Angeles, California
90045
May 9, 1989

Subject: An Objectve Criticism of the FAA's Objectives

Mr. Sterlyn Carroll
U.S. House of Representatives
2251 Rayburn House Office Bldg.
Washington, D.C., 20515

Dear Mr. Carroll:

Just received notice of the Subcommittee on Aviation's meeting yesterday. Hence, cannot comply with testimony requirements. However, believing that there is something that is amiss with the way that the FAA has handled today's air traffic control problems, this letter is written.

For reasons known best to the FAA, that agency is resolved to stay with a totally ground-based form of air traffic control. Keep the pilots flying essentially blind, and have them remain dependent upon air traffic controllers for all traffic information. This attitude has prevailed ever since the FAA closed the door to private collision avoidance system designs in 1975. In place of something that could help pilots help themselves in dense traffic areas, the FAA spent 9 years and many dollars of taxpayer's money in developing their own collision avoidance system called BCAS. Finally, admitting that BCAS couldn't be made to operate reliably in dense traffic areas, it was revised and called TCAS. Here, another 5 years later, TCAS is purported to be a good collision avoidance system, yet it cannot be. For TCAS uses the same radio frequencies as do the ATC beacon systems. TCAS will interfere with ATC transponder communications (secondary surveillance radar), and the ATC transponder communications will interfere with TCAS operations in dense traffic areas. It is because of this known truth that TCAS is designed so that air traffic controllers can command all TCAS II, and TCAS III versions to standby (off) whenever a degradation in ATC communications is noted. Thus, in precisely those dense traffic areas where protection is needed the most, TCAS won't be left available.

While this is a shortcoming of TCAS that alone should warrant its abandonment, there is a worse problem. That is today's air traffic congestion problems existing at major airports throughout the world. Congestion largely due to the limitations in today's air traffic control system. Because the beacon system operates as a radar having poor range resolution, the controllers are required to keep an inordinately large amount of distance between aircraft so that the controllers can always see two close together displayed separately on their traffic display screeens. It is because of this limitation that takeoffs are spaced no closer than 2 minutes apart. Also why landings are 3 minutes apart. Simply by giving pilots their own on-board radar system, they could arrange to schedule operations into and out of existing runways much closer together. That is once a good radar was implemented, and supporting changes were made in the Instrument Flight Rules. With a good radar serving also as a collision avoidance system, takeoffs could be more like 40 seconds apart with safety, and still under the direction of controllers. Landings could safely be just one minute apart. Hence, the capability to almost triple today's capacity (once all needed gates were procured).

This more efficient usage of existing airport facilities could dramatically cut down on the number, times, and costs of flight delays. Could also reduce

the numbers of missed connections commercial passengers now suffer. What might a good radar be ? Simply the equivalent of a good TCAS. A good TCAS could be made today by just divorcing it from the ATC beacon frequencies. Give TCAS its own radio frequency, and use that frequency more efficiently than does either the ATCRBS, or the Mode-S beacon systems. This is saying that aviation today needs both a good data link like Mode-S, and also a fully working, and reliable TCAS. Today, both can be afforded, and provided.

In the past, the cost to mandate implementation of any kind of collision avoidance system in all aircraft was found to be objectionable. Today that is not so. Today, the air transport industry admits to losing $2 billion a year due to flight delay costs. A good TCAS, that could be used at dense traffic airports to expedite traffic flow, could cut those losses by more than half. In the course of just two years with a good TCAS fully implemented, the savings accruing would be more than enough to outfit all commercial and general aviation aircraft with at least basic hardware. Thus, if there were no other way, it would pay the air line companies to foot the whole bill for a good TCAS themselves, rather than continue to do without. Of course, another source for monies that could be used for subsidizing implementation of a good TCAS would be the uncommitted surplus now lying in the Airport and Airway Trust Fund. It would take less than 12% of those monies to equip all aircraft with something good.

You talk to the FAA, or members of the RTCA SC-147 and you will hear nothing but glowing reports of flight tests made by a number of air line companies with TCAS. Yes, those reports are good, and true, but not the least representative of the real world. All TCAS flight tests made to date have been made in environment where only two or three aircraft in any one area had an operating TCAS. Yes, with just a few operating, the present design will work fine. However, once all aircraft are equipped, the promised performance will not be there. It can't, and a little arithmetic will prove it. It would be like having all VHF radio communications take place on just one frequency. Or like citizen's band radio with just one channel. Just too many trying to use the common radio frequencies at the same time.

There is now released a MOPS for a general aviation version of TCAS called TCAS I. the basic TCAS I is no more than a carbon copy of the now abandoned active BCAS. It is a TCAS that uses only the ATCRBS beacon system instead of both the ATCRBS and the Mode-S. Because of this, there are three fatal faults. One is that those opting for TCAS I will find that their system will not give them any protection against aircraft equipped with TCAS II, TCAS III, or Mode-S transponders. They can only communicate with other TCAS I hardware, or Mode A/C transponders, and that is problemmatical at best. This brings up the second fault of TCAS I. Presently, all ATCRBS installations include only a bottom-mounted antenna. A study made by the Lincoln Laboratory staff in 1978 uncovered the fact that whenever communications between aircraft are attempted by way of bottom-mounted antennas, a serious interference problem arises. That is due to the fact that a signal arriving at a receiving aircraft will always be overlapped with a surface-reflected echo. An echo that could be even stronger than the directly received signal. Anytime a signal receiver is subjected to more than one signal at a time there will be destructive interference, or garbling. This always present characteristic will lead to an unacceptable number of false alarms being generated, and also many missed alarms. The problem is especially severe when aircraft are over water as water makes for a good signal reflector.

You buy a TCAS I today, and you'll get virtually no reliable protection at all. What's more, the ATCRBS is now being phased out. Your TCAS I is being obsoleted as it is made. This may be a deterrent to many, and well should be.

Yet look what happens if just 10% of general aviation flying in the Los Angeles basin area go for TCAS I. The TCAS I, unlike TCAS II, and III cannot be commanded off by controllers, and that's the third fault. The FAA has projected that there may be as many as 1105 aircraft simultaneously airborne in the LAX basin area. About 65% of these will be of the general aviation types (718). Hence, if only 10% go for TCAS I, that would place 72 aircraft operating in this area causing interference to TCAS II, and TCAS III equipment, and causing interference to the ATC transponder communications. If allowed to happen there would be no useful ATC communications, or TCAS communications. Utter chaos in the skies would result. How about a TCAS I for all GA aircraft ? Forget it, as its not possible with today's design.

When one becomes aware of these shortcoming of TCAS, there has to be a question coming to mind. Why would that agency of the federal government whose charter it is to help aviation do something that can only hurt in the long run ? There are some who say that it is because a good TCAS would dilute the need for the FAA's grandiose National Air Space Plan. No need to spend as much as $27 billion for updating and enlarging the ground-based air traffic control system, if airborne equipment could provide equal, or greater benefit. When you examine what the FAA now projects for their needs, you have to conclude that spending even $1 billion for airborne equipment, if need be, is fair when compared to what the ground expenditures are now projected to be.

So, as you examine what role the FAA is to play in advancing aviation in the future, please, if nothing else, take the FAA out of the avionic design business. Let the private sector do what the private sector does best. It is OK for the FAA to grade any submitted designs, but never should any government agency be allowed to monopolize product design over the private sector. If you find these allegations hard to believe, think about this. The FAA has been dallying with collision avoidance for over 15 years now and has only this faulty TCAS to show for the money, and time spent. The engineers of this country, working outside of the FAA, were able to place men on the moon, and bring them back safely a number of times, and that effort took only 7 years. Which, in your mind, is the more difficult technical feat ?

If you would like to see relief in air traffic congestion, better on-time performance from air lines, and reduced costs coming from more efficient enroute flying, then take the design of TCAS away from the FAA. It is this writer's opinion that the present design is doomed to utter failure. A failure that will not be fully noticed until there is almost a total committment made by all commercial air lines. If it can't be allowed to work at all times in airborne aircraft, then it certainly can't be used to expedite traffic, or provide dependable safety to anyone.

Just by modifying TCAS to operate on another frequency (no need to discard everything) there can be made a version of TCAS that can serve as a radar able to separately discern two aircraft when there ranges differ by just 40 feet. Today's SSR's require that a range difference of 1.7 nautical miles exist in order that controllers can see two aircraft separately on their screens. That difference can be attained, along with a communications reliability that can remain better than 98% in worst case traffic areas even when all aircraft are equipped and operating at full sensitivity. If anyone on the Aviation Sub-committee would like more information on how this may be done, this writer would be happy to spell it out in language that any layman can understand.

Thank you for your time, and I hope that this at least puts a little different perspective on how the work of the FAA may be viewed.

Respectfully, Ed Gunny

Edmond R. Gunny

STATEMENT OF MICHAEL HEWITT
SECRETARY GENERAL, ORIENT AIRLINES ASSOCIATION
BEFORE THE SUBCOMMITTEE ON AVIATION OF THE
HOUSE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION

HEARING ON
TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEMS

MAY 4, 1989

On behalf of the Orient Airlines Association ("OAA"), I want to express my appreciation to the Subcommittee for the opportunity to express the position of the OAA on the issue under consideration -- whether to extend the deadline for installation of TCAS II devices on all large aircraft operating in U.S. airspace. The OAA strongly believes that, in light of information developed since adoption of P.L. 100-223, the legislatively-mandated final deadline of January 31, 1991, is unrealistic. Accordingly, it should be extended across-the-board by two years, and the FAA should be given the authority to establish a deadline for foreign carriers that accords with standards to be adopted by the International Civil Aviation Organization ("ICAO").

The OAA is the regional trade association for the major international airlines of the Pacific Basin. Its 14 member carriers are: Air Niugini, Air New Zealand, All Nippon Airways, Cathay Pacific Airways, China Airlines, Garuda Indonesia, Korean Air Lines, Japan Air Lines, Malaysia Airlines, Philippine Airlines, Qantas Airways, Royal Brunei Airlines, Singapore Airlines, and Thai Airways International. All of these carriers except Air Niugini

and Royal Brunei serve the United States with scheduled service, and thus have a vital interest in implementation of the TCAS rule.

The OAA applauds the steps taken under the leadership of this Subcommittee and its Chairman toward accelerated implementation of the TCAS II technology. OAA believes these devices will add substantially to the safety of air transportation, and has supported the development of international standards for such systems now in progress in the ICAO. Its position before this Subcommittee in no way indicates a lessening of its members' commitment to the use of TCAS technology. Information gathered by OAA's members, other carriers and industry organizations, and the Office of Technology Assessment,[1/] however, indicates that the interests of safety will be better served by setting a more realistic timetable for implementation.

The OAA's objections may be summarized as follows:

- It will be physically impossible for OAA members to install TCAS on all necessary aircraft by the deadline.
- The intensive work that will be required for U.S. and foreign carriers to meet the deadline will divert mechanics and technical personnel from other necessary maintenance and repair tasks, thereby potentially jeopardizing the safety of operations.
- The virtually simultaneous installation of these devices on all large aircraft using U.S. airspace will allow no

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1/ Safer Skies with TCAS, Office of Technology Assessment, OTA-SET-421, March 1989 (hereafter "OTA study" or OTA "report").

time for evaluation and (if necessary) modification of the system in actual operation.

- The current deadlines will force OAA members to take aircraft out of service, resulting in disruption of airline service to the Far East and hardship to carriers and their passengers.
- Foreign carriers will be affected disproportionately, since they will have to modify a large proportion of their international fleets in order to be in compliance on a relatively small proportion of their operations.
- Failure to coordinate deadlines with ICAO could cause hardship to U.S. and particularly foreign carriers, since they may be subject to differing standards for collision avoidance systems adopted in their home countries.

SAFETY AND LOGISTICAL CONCERNS

The OTA report, the FAA, and various U.S. carriers have identified serious difficulties in marshalling a sufficient number of qualified mechanics and technical personnel to perform the numerous and complicated installation procedures on such a huge number of aircraft within such a tight timeframe. Their conclusion was that it would be virtually impossible for all affected carriers to meet the current deadline.

This is no less true among foreign carriers. The members of OAA are rapidly expanding their fleets (primarily through purchase of new U.S.-manufactured aircraft), and are hard-pressed to meet

their own growing demand for qualified mechanics to perform normal maintenance and repair functions.2/ Moreover, as U.S. carriers face similar shortages, an increasing number are contracting with OAA members such as JAL and Singapore Airlines, or independent bases such as Hong Kong Aircraft Engineering Company ("HAECO") for major maintenance services. This leaves only enough capacity for the OAA carriers to meet occasional unplanned maintenance burdens.

To require the retrofit by December 30, 1991 of all OAA aircraft needed for U.S. service, plus aircraft of U.S. carriers who contract for these services at members' facilities, sets a goal which cannot be met. OAA's member carriers will simply not have enough personnel to accomplish the extensive work in time. Even the attempt to do so could have adverse safety consequences. In the rush to comply with the rule to the extent possible, carriers -- both in the U.S. and abroad -- would have to divert resources from other maintenance tasks. Moreover, with a new and extremely complex system such as TCAS II, it is most definitely not in the interests of safety to force carriers into unworkably tight installation schedules. As the OTA found, "most aviation experts familiar with TCAS II believe such a high installation rate is not a sufficiently prudent course for implementing such a complex safety technology." (OTA Study, at 38.)

2/ At least one OAA member, Qantas, has been forced to curtail plans for expansion because of the shortage of skilled maintenance personnel. Aviation Daily, April 28, 1989 at 202.

The current deadline also creates a serious systemic problem. As OTA recognized, under the current rule carriers will implement the TCAS technology within an extremely short period of time. This will allow no time for evaluation of the technology in actual use. It is quite possible that modifications will be needed, in which case potentially the entire commercial jet fleet used in U.S. airspace will have to undergo rewiring at the same time. This also raises questions about the safety of forcing all operators to rely on a system which, though thoroughly tested on an experimental basis, has no track record of normal commercial use. Because pilots will rely heavily on these devices in aircraft navigation and making critical collision avoidance maneuvers, any systemic imperfections could have serious safety ramifications.

Another problem which militates in favor of extension of the deadline is the effect of the current rule on airline service. To meet the current deadline, carriers will have to take aircraft out of service for several days each, solely for installation. This will play havoc with airline schedules, particularly on Pacific routes. OAA member carriers have, as a class, the highest load factors in the industry, meaning that they have very little room to accommodate passengers from flights which must be cancelled due to aircraft grounding. Moreover, the booming demand for air service on the Pacific, coupled with the long-haul nature of the routes, stretches the carriers' fleets to their capacity, leaving little flexibility for rescheduling and use of backup aircraft. For OAA carriers to be forced to ground a large number of aircraft

outside their normal heavy maintenance schedules would disrupt services in these important international markets, to the detriment not only of the carriers, but the passengers as well.

HARDSHIP ON FOREIGN CARRIERS AND HARM TO INTERNATIONAL AVIATION RELATIONS

In addition to the burdens discussed above, foreign carriers will be affected in ways distinct from U.S. carriers. While U.S. airlines will be subjected to enormous costs and effort to equip their fleets, this burden is more fully justified because all of their operations would be subject to the TCAS rule. Thus, the costs of compliance can reasonably be allocated throughout their entire systems. Foreign carriers, on the other hand, are being forced to modify a substantial portion of their fleets to bring into compliance a relatively small proportion of their operations.

OAA carriers' U.S. operations represent a very important part of their systems, but one that is relatively small in comparison to the number of domestic and intra-Asia flights. Yet to maintain this service, the carriers must make expensive and time-consuming modifications to a large proportion of their international fleets. This is because the necessities of aircraft scheduling do not permit the carriers to dedicate only one or a few aircraft exclusively to U.S. service, and modify only those aircraft. Unless a carrier is willing to risk future flight cancellations and hamstring its ability to change schedules and use backup aircraft, it must bring into compliance all aircraft which may at some time

be needed for U.S. service, in addition to training all crew members who may conceivably be used on these flights.

It is not clear, however, that these enormous costs can be spread throughout the carriers' systems as U.S. carriers can do. To require these costs to be borne by all of the foreign carriers' passengers would be unfair, since most of them, flying in airspace where most aircraft would not be similarly equipped, would probably obtain no benefit from the added costs. This would unreasonably increase the costs of these carriers' U.S. operations, making it more difficult for them to compete not only against other carriers in U.S. markets, but also other carriers in foreign markets who are not forced to install TCAS II.

OAA strongly believes that, in a matter as important as this, the U.S. should coordinate its actions with ICAO, to avoid imposition of inconsistent regulatory burdens on international air transportation. ICAO is currently making progress on international standards for the Airborne Collision Avoidance System (ACAS), with the active support and assistance of the U.S. The FAA estimates that "the technical ACAS equipment specifications in ICAO Annex 10 -- should become applicable internationally in late 1990." (54 Fed. Reg. 940, 942 (January 10, 1989).) At that time, OAA member carriers' governments can be expected to adopt rules applicable to their own carriers.

The U.S. Government's unilateral and extraterritorial action on this issue strains international aviation relations by preempting the accepted processes of adopting standards for aviation. The

U.S. has always supported these processes, and there is no reason to abandon that position in this case, where rapid progress is being made on international standards.

Failure to coordinate both on timing and substantive standards could result in serious conflicts between U.S. and foreign rules. It is foreseeable that, under present law, foreign carriers will equip with the current FAA-approved TCAS II, only to find that their home aviation authorities have adopted slightly different requirements, necessitating removal, modification, and re-installation of this equipment, at a tremendous hardship.

The U.S. Government's unilateral action with respect to foreign carriers is also of questionable legality under the Chicago Convention. Article 33 of that Convention states that "certificates of airworthiness . . . issued or rendered valid by the contracting State in which the aircraft is registered, shall be recognized as valid by the other contracting States . . . ." While they are ostensibly operating rules, the Part 129 provisions preventing foreign-registered aircraft from operating in U.S. airspace without TCAS II equipment effectively deny the validity of these airplanes' certificates of airworthiness.

OAA believes Congress should alter the applicable provisions of Pub. L. 100-223 to avoid setting a time certain deadline for foreign carriers, and should require the FAA to establish technical standards and an implementation deadline consistent with action to be taken by ICAO.

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Again, the members of the Orient Airlines Association appreciate this opportunity to present their views. We hope this Subcommittee, and the U.S. Congress, will take prompt action consistent with their determination to maintain the safety of the nation's airways, and the quality and competitiveness of international air transportation, and extend the current compliance deadline of December 30, 1991 by at least two years, and require that standards and compliance dates for foreign carriers be set by the FAA consistent with ICAO recommendations.

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